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# STEEL TIMES INTERNATIONAL

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Front cover image courtesy of **Tenova**. Tenova strip processing plant - Electrolytic tinning line for Jiangsu Dajiang Metal Material Co Ltd, Dajiang, China

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### Cambodia to build 1Mt/y integrated steel plant

Two Chinese companies have reached a deal to build a 1Mt/y steel plant, 400km rail line and a sea port in Cambodia in a contract worth a combined US\$11.2bn.

The Cambodia Iron and Steel Mining Industry Group (CISMIG) has contracted the China Railway Group to build a railway to link a planned steel facility in northern Preah Vihear province to a port at the southern commercial island of Koh Kong. The rail link and port would cost US\$9.6bn and the steel plant US\$1.6bn. Completion is scheduled for the end of 2016.

Source: *Daily 'The Phom Penh Post', Phom Penh; 1 Jan 2013*

### Krakatau Steel to make auto steels in JV with Japanese

Indonesia's largest steelmaker PT Krakatau Steel (KRAS) and its Japanese partner, Nippon/Sumitomo Steel, will set up a new factory to produce cold-rolled coil (CRC) and galvanized CRC to meet the steel demand from the country's fast-growing automotive industry. KRAS and the recently merged Nippon Steel and Sumitomo Metal Corporation (NSSMC) signed an agreement on 26 December 2012 to set up a joint venture to establish the steel factory, which will be built with investment of US\$378M. KRAS will have a 49% stake in the JV, while NSSMC will control the remaining 51%.

KRAS also signed a joint venture agreement on 26 December 2012 with Osaka Steel Corporation (OSC), a subsidiary of NSSMC, to establish PT Krakatau Osaka Steel which will produce steel beams and other long products for the domestic construction industry.

Source: *Daily 'The Jakarta Post', Jakarta; 28 Dec 2012*

### Watchdog fines Korean steel-makers for price fixing

South Korea's state-run antitrust watchdog has imposed a combined fine of almost 300bn won (\$281M) on seven steelmakers for fixing prices of their steel products. Companies subject to the fine include POSCO, POSCO C&C, Union Steel, Dongbu Steel, Hyundai Hysco, Seah Steel and Seil Steel, according to the Fair Trade Commission (FTC). The seven companies are said to have been involved in separate price-collusion cases between 2004 and 2010 through illegal meetings of their sales executives.

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## Chinese steel sector may bottom out in 2012

After a golden decade of fast growing in the beginning of the 21st century, the severe problem of oversupply in China's iron and steel industry started to take its toll in 2012, a year which witnessed one of the hardest and most challenging for the steel sector. Prices fell, demand declined and costs surged and consequently profits plummeted.

In Q4 2012, boosted by the higher prices and demand, sparked by further stimulus for infrastructure projects by the government and improved house sales, the country's major steel mills began to return to profit. CISA data showed that

major steelmakers registered a total profit of RMB 307M (\$48.1M) in November, the first monthly profit since June. Further price gains are expected in Q1 2013.

China produced 660Mt of crude steel in the first 11 months 2012, up 2.9% from the same period in 2011. In contrast, output grew by 9.8% in the same period 2011. On a monthly basis, November output at 57.5Mt, some 10% more than in October.

China's daily output of crude steel is estimated at 1.945Mt in the first ten days of December, down 0.76% from the previous 10 days, according to the latest data

released by the China Iron and Steel Association (CISA).

China exported 5.13Mt of rolled steel products in the first 11 months 2012, 0.9Mt more than in the same period in 2011, but total exports including semis reached 45.78Mt during the January-October period, an increase of 11.8% from the year earlier.

Imports of rolled products reached 1.07Mt in the same period, 0.16Mt less than it did in the same period in 2011. This strongly indicate damped domestic demand.

Source: *China Metals*

e-mail [chinametal@xinbua.org](mailto:chinametal@xinbua.org)

## Ore prices rise on falling inventories

Iron ore prices in China have increased by more than 50% since their September lows on signs that the country's economy is recovering. Prices climbed to their highest level in five months to US\$126.40/t in mid-December on the back of expectations that pro-growth policies by the world's second largest economy would boost the market.

Import prices of iron ore continued to rise in the week ending on December 24, with mills replenishing stocks amid a tentative rebound in the steel sector. The price index for 63.5%-grade iron ore imports increased six points to 137 during the week, while the index for 58%-grade imports also climbed six points to 118. Positive

November economic data and expectations that the new Chinese leadership will boost growth helped lift the flagging steel industry, prompting mills to restock iron ore and supporting prices of the steelmaking ingredient. The rapid increase in iron ore prices was mainly due to a big drawdown in port inventories.

The report showed that inventories of imported iron ore at 25 major Chinese ports stood at 80.3Mt at 24 December, down 2.41Mt, or 2.91%, from a week earlier according to the Xinhua-China Iron Ore Price Index (Xinhua-China IOP Index) released on Dec. 25. Stocks of imported iron ores at ports continued declining sharply and, ore traders' reluctance to sell

also increased tensions in market supply.

This ore resource strain pushed up prices but steel mills slowed down purchases after the rapid rise in the price of imported ore. Steel mills are expected to become cautious about procurement in the future, which would ease the resource tensions.

Furthermore, cold weather would dampen the demand from downstream sectors, which would be an obstacle to further ore price increases with prices of imported ore likely to rise slightly within a narrow range in the next few weeks.

Source: *China Metals*

e-mail [chinametal@xinbua.org](mailto:chinametal@xinbua.org)

## Asia continues to drive global steel growth

Chinese steel production continues its inexorable rise in 2012. The outcome is expected to reach 760Mt, 5.5% up on the out turn in the previous year. The three main drivers are increases in manufacturing, infrastructure investment and housing. Further, but more modest growth in steel demand is anticipated for the next five years ? pushing up production of steel to 895Mt in 2016. The future percentage rate of expansion in steel-making is forecast to be slower than in the recent past.

The rate of growth in steel output in India is starting to slow but will be recorded at a new all-time high in 2012. The, year-on-year, expansion is expected to be just 3%, whereas in the past decade the

figure has been close to 10%. Reasonable demand for housing and infrastructure will remain into the future leading to solid requirement for steel to 2016.

The recovery of the Japanese steel sector from the 2009 global economic crisis was abruptly halted in 2011 by the March earthquake and tsunami. Modest growth in steel production is predicted in 2012 and beyond as reconstruction in the affected region takes place. The economy is slowly improving but exports are proving difficult to obtain. Steel output should continue to expand but in 2016 is likely to be below the boom year of 2007.

A new peak steel production level will be achieved in 2012 in

South Korea. Domestic demand has not increased significantly but the country's dependence upon imports of semi-finished products has been greatly reduced. Steel output is expected to increase marginally in 2013, and beyond. More new capacity is likely to come on stream next year; lifting domestic supply further. A slowdown in the rate of growth in steelmaking is anticipated in 2014 to 2016.

After adjusting for Chinese under-reporting, Asian total output of raw steel in 2011 was in excess of one billion tonnes. This represents almost 65% of global production. In comparison, the figure ten years earlier was 42%.

[www.meps.co.uk](http://www.meps.co.uk)

# EUROFER welcomes parliament resolution on EU steel industry

The European Parliament has told the European Commission that the steel industry is essential for growth and prosperity in Europe. It is in the interest of the whole European Union and its manufacturing sectors to have a competitive steel industry and to secure supply through domestic production. Strategic initiatives are needed, therefore, to support the sector and to keep it in Europe.

The Parliament applauds Industry Commissioner Antonio Tajani's initiative to develop a European Action Plan for the steel sector, stressing the need to have it presented as soon as possible. All tools available on an EU level helping the industry invest and modernize should be included in the plan. The resolution lists instruments such as increased (Research, Development, Innovation (R&D&I), targeted investment by the European Investment Bank and an active policy for skills, requalification and retraining of workers, amongst other things. The Action Plan should also address the high cost of raw materials and energy, which, the resolution explains, 'are a

threat to the steel industry's competitiveness.'

The resolution acknowledges the steel industry as the backbone of innovation and value creation for many industrial sectors such as the automotive, construction and mechanical engineering. It recognizes the European steel industry as a high-technology industry which 'must be retained by taking immediate action to avoid their relocation outside of EU territory.' It also stresses that strong efforts are necessary since the industry is suffering from a substantial drop in demand caused by the on-going economic crisis.

The Parliament is aware that keeping the steel industry in Europe also presupposes a level playing field with its international competitors. In this context the resolution calls on the Commission to ensure reciprocity in trade politics. It also recommends to keep up the prior surveillance system for imports of steel products and to include that system in the Action Plan. Also, the Parliament recommends establishing a tripartite body formed by the trade unions, the industry and the Commission to

work towards further development of the European steel industry.

The European, which represents 100% of steel producers in the EU, applauds the resolution: "The Parliament rightly points out the strategic role and the technological leadership of our industry. And it clearly defines most, though not all, political issues that have to be worked on urgently to keep our industry competitive on the global markets." Says Gordon Moffat, Director General of the European Steel Association. He stressed that the EU climate targets also need to be discussed if global competitiveness of the European steel industry is to be maintained: "Climate targets not based on technological possibilities and imposed via an isolated EU Emissions Trading Scheme also are a factor that will force the relocation of the industry."

Moffat welcomes the support for Commissioner Tajani's initiative: "Making the changes in policies necessary for a positive impact on industrial competitiveness will be challenging. This initiative indeed needs support, not only from the Parliament but also from the very top of the Commission."

## Signs of recovery for Chinese steel

Signs of a price recovery in Q4 2012 followed months of falling steel. The domestic composite steel price index, the CSPI, released by the CISA, fell below 100 points on Sept. 7, the lowest level ever since June 2009. But the index later picked up and rose to 106.01 points on November 9, pointing to signs of price recovery.

The sentiment is also improved with the growth stimulation measures announced by the government. In September, the National Development and Reform Commission (NDRC) approved 25 new projects for urban railway transport, 13 highway projects and 13 additional railway projects.

Increasing to 22 projects from the initial 9 projects, the railway construction projects are the highlights of Q4 2012, with the full-year fixed assets investment in the

sector rising to RMB 630bn (US\$98.9bn) from the previously estimated RMB 516bn (\$81bn). After months of correction, upstream sectors, the real-estate industry for instance, have begun to show signs of recovery.

In November, the sales, investment, land auctions, construction, and new starts all registered faster growth. According to the latest statistics from the National Bureau of Statistics of China (NBS), nationwide investment in the property sector jumped 16.7% y-o-y in the January-November period, totalling RMB 6477bn (\$1016.6bn). Meanwhile, the country's house sales totalled 917Mm<sup>2</sup> in the first 11 months of 2012, up 2.4% from a year ago. The sales value rose 9.1% y-o-y to RMB 5352.5bn (\$840bn), with the growth rate 3.45% higher than that

in the January-October period.

Many property developers say they have achieved their annual sales targets for 2012 in advance or their sales had exceeded the 2011 total.

Boosted by the higher price and demand, the country's major steel mills began to return to profit in the last quarter. CISA data showed that major steelmakers registered a total profit of RMB 307M (\$48.1M) in November, the first monthly profit since June. Further price gains are expected in Q1 2013.

With the policy prospect going steady, China's steel sector has already bottomed out, according to experts. They suggest that China's steel demand in 2013 will return to its normal pattern of seasonal fluctuations as in previous years.

Source: *China Metals*  
e-mail chinametal@xinhua.org

## Upsizing LanzaTech's CO to ethanol plant

LanzaTech, a producer of low-carbon fuels and chemicals from waste gases, and Baosteel, China's second largest steelmaker, have

announced the success of their 100 000 gallon per year (300t) pre-commercial plant located at one of Baosteel's Shanghai mills.

The plant produces ethanol from CO captured in the BOF plant using a microbial fermentation process.

### Jazeera Steel to stop exports to Canada

Sohar based steel pipes manufacturer Al Jazeera Steel Products has decided to cease exports to Canada following Ottawa's decision to impose steep anti-dumping duties on its pipe products.

The Canada International Trade Tribunal (CITT) has imposed an anti-dumping duty amounting to 54.2% on its pipe exports to Canada. Source: *'Oman Daily Observer', Muscat; 17 December 2012*

### Baosteel to invest in 5000km gas pipeline

Shanghai based Baoshan Iron and Steel Co announced it will invest RMB 8bn (US\$1.25bn) on the third West-East gas pipeline project initiated by China National Petroleum Corporation (CNPC). Baosteel will hold a 12.8% stake in the joint venture with CNPC.

Also, Huabao Investment Corp, a wholly-owned subsidiary of Baosteel Group, will invest RMB 2bn (\$314bn) on the gas pipeline project and take a 3.2% stake in the venture.

Source: *China Metals*  
e-mail chinametal@xinhua.org

### Indonesia calls for duty on steel imports

The Indonesia Anti-Dumping Committee (KADI) says it will ask the government to impose antidumping duties of up to 68% on imported cold rolled coil and sheet steel to stop dumping.

Steel imports from China, Japan, South Korea, Taiwan and Vietnam have seriously injured local manufacturers of similar items, KADI chairman Bachrul Chairi said in Jakarta 21 Dec.

Source: *Daily 'The Jakarta Post', Jakarta; 22 Dec 2012*

### China meets elimination target for obsolete plant for 2011

The government reached its target for elimination of outdated iron and steel production capacity in 2011, the Ministry of Industry and Information Technology said on Dec. 25.

Among the total, 31.92Mt of obsolete iron-smelting capacity, 28.46Mt of steel capacity were phased out in 2011. China has been stepping up efforts to build an environmentally friendly and energy-efficient society by unveiling stricter emission standards and speeding up the elimination of outdated production capacity in multiple industrial sectors.

Source: *China Metals*  
e-mail chinametal@xinhua.org

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## SMS sees a reluctance to place orders

The SMS group has noticed a reluctance among its customers to place orders. It is estimated that order intake in 2012 will total €3.2bn putting it below 2011's €3.42bn. Sales in 2012 are anticipated to reach just above €3bn (2011: €3.07bn).

## China set for Japanese steel duty consultation

A consultation request from Japan over duties levied on its steel tube exports to China will be handled according to dispute settlement procedures of the World Trade Organization (WTO), says China's Ministry of Commerce.

Japan requested early consultations with China at the WTO concerning China's decision to levy anti-dumping duties on Japanese exports of high-performance stainless steel tubes which are mainly used in coal-fired power plants. The duties imposed in November range from 9.2% to 14.4%, on imports from both Japan and the European Union. The duties are intended to remain in place for five years.

Source: *China Metals*  
e-mail [chinametals@xinhua.org](mailto:chinametals@xinhua.org)

## Wusteel's profits drop 73% y-o-y

Wuhan Iron and Steel Group Corp is expected to generate RMB 200bn (US\$31.4bn) of sales revenue in 2012 with profits at about RMB1.7bn (\$266.8M).

In 2011, sales revenue of the steelmaker amounted to RMB 218bn (\$34.2bn), while profits stood at RMB 6.4bn (\$1000M).

The non-steel business of the group is predicted to yield RMB 3bn (\$470.8M) of profits in 2012, up 32% from a year earlier. Deng Qilin, general manager of the group, said that the company would strive for meagre profits in steel businesses in 2013 and below normal development in its non-steel businesses.

Source: *China Metals*  
e-mail [chinametals@xinhua.org](mailto:chinametals@xinhua.org)

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## Outokumpu acquires TK Inoxum

Finnish stainless steel producer, Outokumpu and the German steelmaker, ThyssenKrupp AG have completed the amalgamation of their stainless steel activities with the acquisition of ThyssenKrupp Inoxum by Outokumpu.

ThyssenKrupp becomes a major shareholder in Outokumpu through a directed share issue, holding 29.9% of the shares. Guido Kerkhoff, CFO of ThyssenKrupp joins the Board of Directors of Outokumpu.

The new company started operations on December 29, 2012 with a new structure and leadership aimed at creating significant annual cost synergies of EUR 200M, of which EUR 50M are expected in 2013, and cumulatively up to EUR 150M by 2014.

The new company has close to 40% of the European market and 12% globally. It also has the broadest portfolio in the industry and technical expertise and customer knowledge making Outokumpu a clear global major in stainless steel and high performance alloys.

Outokumpu now has four business areas – Stainless Coil EMEA, Stainless Coil Americas, Stainless APAC and High Performance Stainless & Alloys. Together these provide the full range of stainless steel products as well as high performance alloys. Outokumpu benefits from having its own chrome

mine and related ferrochrome production, which brings the company a significant cost advantage over most other stainless manufacturers.

The combined entity presently has approximately 16 900 employees, combined revenues of EUR 9.6bn (based on 2011 pro forma) and annual cold rolling capacity of approximately 2.8Mt. The company is led by CEO Mika Seitovirta.

To achieve the targeted efficiency increases, the combined entity plans to reduce its melting capacity by approximately 1.4Mt. In accordance with the agreement announced on January 31, 2012 among Outokumpu, ThyssenKrupp and the German labour representatives, the Krefeld meltshop will shut by the end of 2013 and it is envisaged that the meltshop in Bochum will be closed by the end of 2016, pending a final review of its financial performance in 2015. Furthermore,

Outokumpu will consider a reduction of thin cold rolling capacity in Sweden from 2014 onwards.

The overall global restructuring is expected to result in a reduction of up to 2000 jobs over the next four years. These measures will strengthen the combined entity's financial profile and, in turn, provide greater job security in the future. All changes will be conducted in a socially responsible manner whilst limiting impact on customers.

## Malaysian Government insists on 50% local steel

Malaysia's Mycron Steel Bhd has agreed to continue buying 50% of its hot rolled coil from Megasteel Sdn Bhd and the other half from abroad provided three conditions are met.

International Trade and Industry Minister Datuk Seri Mustapa Mohamed has reportedly told Mycron in a meeting earlier this month that the Government would still require it to procure hot rolled coils (HRC) from Megasteel, the country's sole producer of the material, and import the rest, which is the current practice. Megasteel is owned by the Lion Group and Mycron Steel by Mycron Steel Bhd.

The decision is said to have been a blow to local cold-rolled coil (CRC) makers as most steel players are in the red, with industry

utilisation rates at a paltry 31%.

Mycron chairman and major shareholder Tunku Datuk Yaacob Tunku Abdullah said, after the company's AGM on 13 December 2012, that it had agreed in principle with the ministry based on three conditions: consistency of product quality from Megasteel; a reduction in duty-exempt CRC imports; and an independent audit to ensure that Megasteel does not enjoy any transfer pricing advantage between its upstream and downstream operations.

Although the final decision rests with the minister, Tunku Yaacob said he was optimistic Mycron's conditions would be met. The Economic Council has also given its consent to the policy.

Source: *Daily 'The Star'*, Kuala Lumpur; 14 Dec 2012

## Wusteel & Baosteel buy back shares

Wuhan Iron and Steel (Wusteel) plans to raise a maximum of RMB 15bn (\$2.35bn) via a private placement to buy assets from its parent. According to a filing to the stock exchange, the steelmaker said it would issue up to 4.2bn new shares at not less than RMB 3.6/share (\$0.56) to not more than 10 investors, including its majority shareholder Wuhan Iron and Steel Group Corp.

It will use the proceeds to buy mining assets including overseas iron ore assets in Brazil and Australia from its parent. Wusteel also announced that its parent plans to overweight up to 500 million A-shares in the next 12 months. The majority shareholder, Wuhan Iron and Steel Group Corp., added holdings in the listed unit at a maximum price of RMB 4/share (\$0.63).

Meanwhile, Shanghai Baoshan Iron and Steel Co (Baosteel) announced that it had bought back about RMB 1.81 million worth of its own shares as of Dec. 3. The move is part of a previously announced plan by Baosteel to buy back up to RMB 5bn (\$784M) worth of shares. It said in a filing to the Shanghai Stock Exchange that it had bought back 393.08 million shares, or 2.2% of its total share capital, at RMB 4.51-4.69 each (\$70-0.73) since it announced the plan in late August in a bid to protect shareholders value and boost investor confidence.

Source: *China Metals*  
e-mail [infochn@public.bta.net.cn](mailto:infochn@public.bta.net.cn)

## Qatar/Algeria steel plant deal

Algeria and Qatar have signed an accord for the construction of a steel plant in Algeria.

The agreement is to jointly build a steel plant in the Bellara industrial zone near Jijel, 359km east of Algiers with a production capacity of 10Mt/y. The aim is to help Algeria reduce its import costs by an estimated \$10bn annually, or 20%.

This was one of eight accords signed between the two countries. Source: *Daily 'Gulf Times'*, Doha & *Daily 'Qatar Tribune'*, Doha.

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## November crude steel up 5% y-o-y

World crude steel production for the 62 countries reporting to the World Steel Association (world-steel) was 122 million metric tonnes (Mt) in November 2012, an increase of 5.1% compared to November 2011.

China's crude steel output for the month was 57.5Mt, up 13.7% compared to November 2011. Elsewhere in Asia, Japan produced 8.5Mt of crude steel, a decrease of -2.3% compared to November 2011 and South Korea's crude steel production was 5.6Mt in November 2012, -2.7% lower than November 2011.

In the EU, Germany made 3.4Mt of crude steel in November 2012, a slight decrease of -0.2% on November 2011. Italy's crude steel production was 2.2Mt, down -12.9% compared to November 2011. In France, crude steel production was 1.3 Mt, a decrease of -5.4% on November 2011. Spain produced 1.0Mt of crude steel, -14.2% lower than November 2011.

Turkey made 3.0Mt crude steel in November 2012 an increase of 4.6% compared to November 2011. In November 2012, Russia produced 5.5Mt of crude steel, a decrease of -0.7% compared to the

same month last year. Ukraine's crude steel production for November 2012 was 2.7 Mt, -7.9% less than November 2011.

The US produced 6.7Mt of crude steel in November 2012, down -4.8% on November 2011. Brazil's crude steel production for November 2012 was 2.8Mt, an increase of 2.4% compared to November 2011.

The crude steel capacity utilisation ratio for the 62 countries in November 2012 declined to 76.1% from 76.5% in October 2012. Compared to November 2011, it was 1.6% higher.

For full listing of monthly statistics by country visit

[www.worldsteel.org/statistics/crude-steel-production.html](http://www.worldsteel.org/statistics/crude-steel-production.html)

## Vale allocates \$16bn expenditure for 2013

Brazilian miner, Vale, has announced its investment plans for 2013. Capital expenditure allocated for new projects is US\$10.1bn and \$5.1bn will be used to sustain existing projects. A further \$1.1bn has been allocated to Research & Development.

Capital and R&D expenditure in 2012 is estimated to have been \$17.5bn. Peak expenditure took place in 2011 reaching \$18.0bn.

A moderate expansion for minerals and metals is forecast over the medium term.

The bulk of the expenditure has been allocated to iron ore (46.9% = \$7650M) while coal mining receives a 10.6% share (\$1735M).

Vale's excursion into joint venture steelmaking receives 3.2% or \$520M. In addition to its existing share in the 5.5Mt/y iron and slab production plant CSA (Companhia Siderúrgica do Atlântico) built by ThyssenKrupp which started production in September 2010 in the State of Rio de Janeiro, Sergio Cabral. Vale has announced a JV with Posco and Dongkuk of South Korea to build a 3Mt/y steelworks in Ceará, Brazil which is expected to start production in H1 2015. Known as CSP, Vale will hold a 50% stake and invest \$2648M as its share of the project. Vale say their investment in CSP is 'risk free' as Posco and Dongkuk guarantee to take 100% of production while Vale will supply the ore. This is unlike the CSA

project which proved more costly to build and operate than anticipated and required Vale to increase its initial stake from 10% to 27% with a further capital investment of around \$1260M.

Estimated ore production for 2013 is 306Mt plus 43Mt of pellet and 12.4Mt of coal – both coking and thermal. Ore output is projected to increase to 402Mt by 2017 of which 43% will come from new projects.

Vale recognise an increase in silica content of the ore which reached close to 4% in 2012 and are taking in hand beneficiation projects to reduce this to below 2.5% by 2019. Also, some of the new projects to be developed are low in silica. In perspective, Australian ore averages 4.5% SiO<sub>2</sub>. Fe content will also benefit from ore treatment increasing from a low averaging 64.5% in 2012 improving to 66% by 2018. Vale recognise that the moisture content of their ore fines is high and point out this is the result of operations taking place in a rain forest climate.

The main initiatives are responsible for 85% of the US\$ 10.126 billion budgeted for project execution in 2013 are:

- Carajás, expansion of integrated iron ore operations (\$ 2.112bn), comprised additional outputs of 40Mt/y at Carajás; Serra Leste 6Mt/y; CLN 150Mt/y; Carajás Serra Sul S11D 90Mt/y and

CLN S11D2 projects.

- Itabirito: capacity replacement, increase and quality improvement in the iron ore from the Southern/Southeastern Systems (\$1.129bn), includes the Conceição Itabirito, Conceição Itabirito II, Vargem Grande Itabirito and Cauê Itabirito projects.

- CSP steel (US\$ 439 M).

- Global distribution network (\$ 758M), including the construction of the Teluk Rubiah distribution centre, a second floating transfer station in Asia (\$33M), ships (\$ 276M) and barges (\$6M).

- Tubarão VIII pellet plant (\$1088M) 7.5Mt/y.

- Construction and ramp-up of the Moatize/Nacala coal operation (\$ 1.439bn).

- Long Harbour (\$ 1.216bn), an integrated nickel smelting and refining plant, with lower operating costs and lower particulate emissions, increased metal recovery, higher efficiency and reduced energy consumption.

Other projects cover copper, gold, potash and cargo transport.

The remainder of the capex budget is allocated to the re-opening of the Totten nickel mine, several small projects to improve productivity in iron ore mining and to debottleneck iron ore logistics and some programmes with smaller capex, such as Eagle Downs (coal), Carnalita and Biodiesel.

### February

#### 5-7 Steel Success Strategies - Turkey

Istanbul organised by World Steel Dynamics & Metal Bulletin Events [www.metalbulletin.com/EventDetails/0/4483/Steel-Success-Strategies-Turkey.html](http://www.metalbulletin.com/EventDetails/0/4483/Steel-Success-Strategies-Turkey.html)

#### 13-14 18th Annual Russian & CIS Metals Summit

Moscow Marriott Grand Hotel, Organised by Adam Smith Institute, London [www.adamsmithconferences.com/event/steel-metals-russia-cis](http://www.adamsmithconferences.com/event/steel-metals-russia-cis)

#### 13-14 Stahlmarkt 2013

Düsseldorf Organised by Handelblatt Addresses the economy and the sovereign debt crisis in the euro area [www.handelblatt-stahlmarkt.de](http://www.handelblatt-stahlmarkt.de)

#### 21-23 Metal & Steel 2013

Cairo International Exhibition Centre Organised by Arabian German Exhibitions Ltd [www.metalsteelgroup.com](http://www.metalsteelgroup.com) e-mail [marketing@arabiangerman.com](mailto:marketing@arabiangerman.com)

### March

#### 5-6 CRU's 19th World Steel Conference

Hong-Kong Shangri-La Hotel, Kowloon Hong Kong organised by CRU [www.crugroup.com/events/steel](http://www.crugroup.com/events/steel) e-mail [conferences@crugroup.com](mailto:conferences@crugroup.com)

#### 11 Platts 2nd Annual Scrap Seminar

Chicago Organised by Platts Tel 781-430-2115 e-mail [erica\\_giardina@platts.com](mailto:erica_giardina@platts.com)

### 12-13

#### Platts 9th Annual Steel Markets

North America Conference Chicago InterContinental Hotel organised by Platts Tel 781-430-2330 e-mail [nathaniel\\_connors@platts.com](mailto:nathaniel_connors@platts.com)

#### 27-29 11th China International Steel

Market and Trade Conference Guangzhou, China Organised by MC-CCPIT e-mail [chiu@mc-ccpit.com](mailto:chiu@mc-ccpit.com)

### May

#### 6-9 AISTech 2013

Pittsburgh, PA, USA Organised by AIST [www.aist.org/aistech/](http://www.aist.org/aistech/)

## US steel imports up in November

Steel imports to USA increased 2% in November over October according to preliminary government data. Both NAFTA totals and non-

NAFTA imports were essentially unchanged in the month to month comparison as consumers continued to show caution in their import

ordering.

Imports for the year-to-date period were 17% higher in the first 11 months of 2012 compared to 2011.

### VISIT:

[www.steeltimesint.com](http://www.steeltimesint.com)

To see a full list of news and features. Click on 'news'

# Keith Busse voices sentiments on US steel

SDI's Busse addresses AIIS while Nucor's DiMicco hands on CEO role as US steel profits falls with growing imports.

By Manik Mehta, New York

AT its 62nd annual dinner held on November 29 in New York, the American Institute for International Steel (AIIS), which claims to promote economic growth through open markets and free and responsible trade, invited a steel icon as the event's keynote speaker whose credentials include not only heading steel-making companies but also having a commanding voice which gets an attentive ear in the nation's political circles on issues of interest to the steel industry.

Keith Busse, the co-founder and the chairman of board of directors of Steel Dynamics Inc, an EAF integrated steelmaker using two rotary hearth technologies to produce iron, addressed the AIIS members at the Hilton Hotel in New York.

Busse who led SDI from a start-up to a multibillion dollar company, advancing to become one of the nation's largest and most profitable steel companies, has served as chairman of the Steel Manufacturers Association

and the American Iron and Steel Institute; he has also received international accolades, including the Willy Korf/Ken Iverson Steel Vision Award in 2008, the Iverson Selig Award in 2006, the AIST's 'Steelmaker of the Year Award' in 2005, and the ASD 'Steel Man of the Year Award' in 2004.

Before he began his address, Busse had a one-on-one conversation with *Steel Times International*, in which he spoke of the 'challenges' facing the US steel industry which is still mired in recession – some AIIS members privately described as the "great recession" – touching on the weakening international demand for US-made steel, evident in the latter part of 2012.

Addressing the AIIS gathering, Busse recalled that SDI had started to make profit only six months after it was launched. "It generally takes, at least, two years to achieve that ..." he said, adding that Wall Street had called it a 'phenomenal success'. SDI has become

the nation's fifth largest steel producer. "We are now a vertically integrated metals company," Busse said. But he emphasized that the focus should be on building "good customer relations".

By reducing bureaucracy within the company, SDI has become competitive even against China, offering advantages such as low-cost production, a diversified value-added portfolio, a performance sustainable cycle and a very strong capital structure.

The main drivers of the international steel market were still the United States, China and Europe, with Brazil and Russia following thereafter. "China's economy is showing signs of a slowdown, and the US is still in a recession, in my view," he said.

He called for "less government" in business and industry, and wanted an energy policy that was not be inhibited by restrictive laws. He said he was a "firm believer" in removing barriers and subsidies, creating a level-playing field. ■

## Gloomy clouds over steel industry

THE third quarter results of steel companies such as ArcelorMittal, United States Steel Corp, Nucor Corp and AK Steel Holding Corp, convey a gloomy outlook, in general, for the industry, with falling revenues precipitated by a drop in steel prices and shipments.

Weak demand for steel, coupled with the glut-like situation characterizing steel supply and rising steel imports, have affected steel prices and hurt margins.

According to industry forecasts for the fourth quarter 2012, ArcelorMittal expects iron-ore shipments to grow by 10% in 2012 over the 2011 level. The company, cautiously navigating through the critical economic situation, particularly in Europe, has been idling plants. Its ongoing dispute with the French Government – a French minister reportedly said that Mittal was "not welcome" in France – is being closely watched in US steel circles. Some US analysts privately said that ArcelorMittal's intention to cut its annual dividend by 73% to 20 cents a share was "dramatic".

United States Steel expects that its segment results will be affected in the fourth quarter, attributed to lower average realized prices and lower shipments. Its tubular agreement is expected to deliver profits but these will be much lower than the third quarter level.

As of going to print, AK Steel had not provided any specific range of loss for the fourth quarter, although it expected to post a loss in the final quarter. Nucor also expects fourth-quarter profits to be reduced.

The US steel industry has not made its final assessment of the extent of the damage caused by Hurricane Sandy which had devastated the country's east coast in the last week of October. Nucor had suspended operations at its Connecticut rebar and wire-rod mill while United States Steel has temporarily stopped its operations in the eastern part of Pennsylvania.

According to the AISI, steel shipments in September 2012 were down 13.7% from the 8.377M net tons shipped in August 2012, and

a 9% decline from the 7.947M net tons shipped in September 2011. However, steel shipments on a year-to-date (to September 2012) were 73.628M net tons, a 7.8% increase over 68.441M net tons for the first nine months of 2011.

A comparison of September shipments with the previous month of August shows cold rolled sheet, down 6%, hot dipped galvanized sheets and strip, down 11% and hot rolled coil, down 22%.

A number of steel companies, including US Steel Corp have again been raising alarm over rising steel imports they claims are driving down prices and creating a glut-situation with an oversupply of the metal.

US Steel Chairman and CEO John Surma told analysts during the company's third-quarter earnings call on October 30 that two of the company's business segments – flat-rolled and tubular – were experiencing the effects of imports boosting supply beyond utilization and deflating market prices. ■

## AISI say China is a currency manipulator

THE American Iron and Steel Institute (AISI), which describes itself as the 'voice' of the North American steel industry, expressed its 'extreme disappointment' over the US administration's failure to name China as a 'currency manipulator' in the Treasury Department semi-annual report.

Thomas J Gibson, the AISI President and CEO, said that China's unfair trade practices were an election issue, which evoked considerable interest amongst the public. "In fact, a national survey of voters indicated that 83% support getting tougher on China to reduce its producers' unfair advantage in global trade that they

gain by violating trade rules. Declaring China a currency manipulator would be an important step toward correcting America's long-standing trade imbalance with China," Gibson said in a statement.

"We believe that Congress should pass, and the Obama Administration should support, a trade law remedy fix to this problem of currency manipulation, which has contributed to the current \$232bn US trade deficit with China. By holding the value of its currency artificially low, China is in effect subsidizing the export of its goods to the United States," Gibson said. ■

## DiMicco hangs up his boots

ON another front, one of the steel industry's best-known personalities, Daniel R DiMicco, chairman and CEO of Nucor Corporation, and former chairman and current director of the AISI, announced that he will pass on his CEO responsibilities to current president and COO, John J Fernola, on January 1, 2013. DiMicco will, however, remain Nucor's executive chairman.

The AISI president and CEO, Thomas J Gibson, described DiMicco's "dynamic leadership" as "invaluable in advancing the industry pro-manufacturing agenda". ■

# Predicting the Latin American steel market in 2013

The end of a year is usually dedicated to analysing the results of the past 12 months as well as forecasting the coming years. The data required is more accurately obtained for larger countries in Latin America, such as Brazil and Mexico, while that on smaller markets such as Ecuador, Costa Rica, and Paraguay leads to more volatile results. **By Germano Mendes de Paula\***

THE estimate of steel demand in Latin America for 2013, made by the Latin American Steel Association, Alacero, in its recent publication 'Latin America in Figures 2012' shows that apparent finished steel consumption in the region is expected to reach 64.8Mt in 2012 and 68.5Mt in 2013, representing a 4.2% and 5.7% improvement y-o-y (Fig 1). These predictions are consistent with the Short-Term Outlook of the World Steel Association (worldsteel).

Considering the 2005-2013 period as a whole, steel demand in Latin America is set to grow by 43.9%, which is equivalent to a 4.7% Compound Annual Growth Rate (CAGR).

Apparent consumption for the ten Latin American countries since 2005 is shown in Table 1. The most important trend is that Mexico's share of apparent steel demand in Latin American countries has dropped 6.8%, from 17.2Mt in 2005 out of a total for the region of 47.6Mt ie 36.1% to 29.3% in 2013. On the other hand, Peru has increased its share by 2.3%, Brazil by 2.2% and Ecuador 1.1%. For the remaining nations, the change is below 1.0%.

Fig 2 uses the data from Table 1 to compare the rate of change in apparent steel consumption for 2011/12 and the 2012/13 forecast. This provides a short-term perspective, demonstrating the rate of change of consumption for each country y-o-y. Brazil is expected to increase apparent steel demand by 2.4% in 2012 and 4.2% in 2013, while the respective figures for Mexico are 7.2% and 4.1%. Argentina is the only country to experience a fall in growth rate in 2012 (of 13.0%) followed by a forecast partial recovery of 4.3% in 2013. In contrast, Venezuela is expected to grow by 19.2% in 2012 and 16.1% in 2013. Impressive expansion is also forecast for Chile (20.0% in 2012 and 13.3% in 2013) and Peru (12.5% and 11.1%), while Colombia would experience an increase of 3.1% and 6.1% over the period.

For the smaller markets, mainly because of rounding of numbers, the statistics are more volatile than what is actually experienced. For instance, Paraguay is expected to increase its consumption from around 200kt in 2011 to about 300kt in 2012/13, resulting in a 50% growth between 2011/12 but with no change (zero growth) between 2012/13. For Costa Rica, the estimated change is 14.3% and zero, respectively and for Ecuador, zero and 5.6%.

Fig 3 shows the CAGR for demand during the period 2005-2013, which provides a medium-term perspective. Peru and Paraguay have been experiencing the fastest growth rates (14.7%), followed by Ecuador (11.4%), Chile (6.2%), Costa Rica (6.1%) and Colombia (6.0%). Amongst the larger markets, Brazil has the best performance (5.4%), followed by Venezuela (4.7%) – the same as the average for the region) and Argentina (4.3%). Mexico has the poorest outcome, with a 2.0%/y rate of growth. Despite the outstanding recent performance of the Mexican steel market (Fig 2), in 2013, its apparent steel consumption will be marginally lower than the maximum observed in 2006.

	2005	2006	2007	2008	2009	2010	2011	2012	2013
Argentina	3.5	4.2	4.5	4.4	3.4	4.6	5.4	4.7	4.9
Brazil	17.7	16.8	22.2	24.1	24	26.1	25.3	25.9	27
Chile	2.1	2.3	2.4	2.7	1.7	2.4	2.5	3	3.4
Colombia	2.2	2.9	3.1	3.2	2.6	2.8	3.2	3.3	3.5
Costa Rica	0.5	0.5	0.5	0.7	0.5	0.5	0.7	0.8	0.8
Ecuador	0.8	1.4	1.2	1.3	1.6	1.3	1.8	1.8	1.9
Mexico	17.2	20.3	19.5	19.1	14.9	16.9	18	19.3	20.1
Paraguay	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.3
Peru	1.0	1.4	1.5	2.1	1.5	2.4	2.4	2.7	3.0
Venezuela	2.5	3.1	4.0	3.1	2.2	2.3	2.6	3.1	3.6
Latin America	47.6	52.9	59.1	60.8	52.5	59.5	62.2	64.8	68.5

**Table 1 Latin American apparent consumption of finished steel by country 2005-2013 (Mt)**

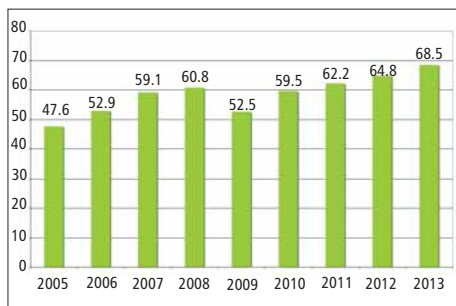
Alacero's publication also contains forecast for international trade of finished steel. The import penetration, defined as imports as a proportion of apparent steel consumption, for the region and individual countries is shown in Fig 4. For Latin America as whole, this ratio has increased from 20.4% in 2005 to 27.4% in 2011. This is expected to grow to 28.0% in 2012, but fall again to 26.5% in 2013. In the Brazilian experience, following the jump from 3.4% in 2005 to 14.2% in 2011, there is expected to be a trend of retraction, import penetration falling to 13.7% in 2012 and 11.6% in 2013, a factor that is partially explained by the recent temporary increase in import tariffs on selected steel products. In Mexico, the market share of imports increased from 27.5% in 2005 to 32.2% in 2011 and has since stabilised.

During the period 2005-2013, import penetration increased, in most of the remaining nations, gaining 13.0% in Chile, followed by Ecuador (8.25%), Venezuela (7.5%), Argentina (3.2) and Peru (3.0). None the less, this index will fall in Costa Rica (-28.9%), Colombia (-11.1%) and Paraguay (-3.3%).

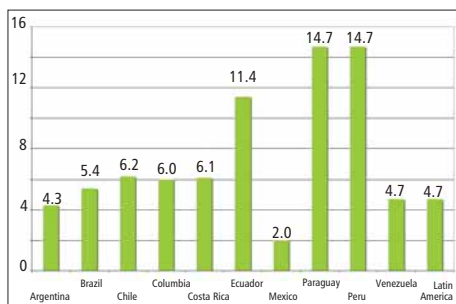
In conclusion, apparent finished steel consumption in Latin America is forecast to grow by 4.2% in 2012 and 5.7% in 2013.

In addition, steel imports will maintain almost at the same level which explains why import penetration in the region will fall from 28.0% in 2012 to 26.5% in 2013.

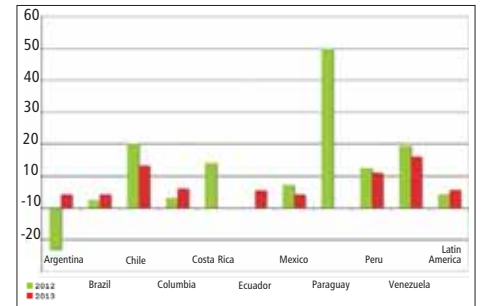
While, Latin American steelmakers will still be very far from bonanza times in 2013, they most probably will be in better shape compared to 2012. ■



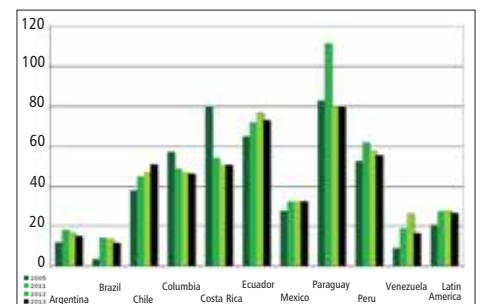
**Fig 1 Apparent consumption of finished steel in Latin America 2005-2013 (Mt)**



**Fig 3 Compound Annual Growth Rate of apparent consumption of finished steel, by LA country 2005-2013 (% CAGR)**



**Fig 2 Rate of change of apparent consumption of finished steel by LA country 2011/12 and 2012/13 (% y-o-y)**



**Fig 4 Import penetration of finished steel by LA country 2005-2013 (%)**



# Steel growth slows as industry flops in FY H1

India's industrial performance in the first half of the financial year (FY April 12-March 13) has shown a marked slowdown compared with the same period a year earlier. Automotive production in particular has been hit and, while steel consumption grew 4.37%, profits are down as a result of increasing raw material costs, even domestic ore seeing marked hikes. **By Sanjay Sengupta\***

ELUDING hopes in official quarters of a turnaround in the economy, India's Index of Industrial Production (IIP) during April – September, 2012 (H1 of FY'13) recorded a dismal growth of 0.1% compared with 5.1% a year earlier (H1 FY'12). The manufacturing sector, which has a weightage of 75.5% of IIP, grew by just 0.13% compared to 5.4% in H1 FY'12.

The Core Sector, representing eight infrastructure industries, grew a more significant 3.2% but less than the 5% of H1 FY'12.

Despite this gloomy picture, India's crude steel production recorded a growth of 4.84% and the country's consumption of finished carbon steel rose 4.37% over H1 FY'12.

## Sharp decline in automotive growth

The growth of India's auto sector, which attained high levels in the past few years, nosedived in H1 FY'13. Overall, the sector recorded a meager growth of 2.44% in production, 3.62% in domestic sales and posted a decline of -5.96% in exports in H1 FY'13 compared with H1 FY'12 (Table 1).

## Crude steel production

India's total crude steel production in H1 FY'13 was 38.46Mt, an increase of 4.6% over the 36.69Mt for the same period of the previous year. Details of production in H1 of FY'13 and variance with H1 of FY'12 are shown in Table 2.

JSW Steel Limited was the highest individual producer of crude steel in H1 of FY'13 with an output of 4.31 Mt.

## Ferrous sales

Production for sale is arrived at by deducting inter-plant transfers (IPT) and producers' own consumption from gross production. 35.14 Mt of finished carbon steel was available for sale in H1 FY'13, up 2.79% over H1 FY'12. A summary of production for sale of iron and steel products is shown in Table 3.

The low rise of 2.79% in production for sale was due to a negative growth of -1.36% in the long product segment in H1 FY'13 which reached 16.67Mt, compared to 16.90Mt in H1 FY'12. The negative growth was due to a sharp decline in demand from infrastructure and other relevant sectors.

## Steel trade

Imports of finished carbon steel in H1 FY'13 at 3.02Mt, rose 33.63% over the 2.26Mt imported in H1 FY'12. Major imports by product were HR Coils (0.81Mt), CR Sheets / Coils (0.78Mt) and Plate (0.41Mt).

Exports of finished carbon steel at 2.12Mt in H1 FY'13 rose 5.47% over 2.01Mt in H1 FY'12. Major exports were GP/GC sheets (0.79Mt) and HR Coils (0.6Mt). India remained a net importer of finished carbon steel in H1 FY'13.

Type of vehicle	Production H1 FY'13	% change over H1 FY'12	Domestic sales H1 of FY'13	% change over H1 FY'12	Exports H1 FY'13	% change over H1 FY'12
Passenger Vehicles	1562916	5.29	1278763	6.96	267544	2.77
Commercial Vehicles	411078	(-) 4.58	385673	3.71	44017	1.91
Three Wheelers	377177	(-) 14.77	250497	0.59	136293	(-) 30.91
Two Wheelers	7840867	3.28	6779219	3.12	1003053	(-) 3.75
<b>Total</b>	<b>10 192 038</b>	<b>2.44</b>	<b>8 694 152</b>	<b>3.62</b>	<b>1 450 907</b>	<b>(-) 5.96</b>

Source : SIAM Unit: Number of Vehicles

**Table 1 Automotive sector performance**

Product	Production in H1 of FY'13 (p)	% change over H1FY'12
Crude Steel Total	38462	4.84
of which ISP's (1)	12007	3.31
Secondary (2)	26455	5.55

Source: JPC (P) = Provisional

Note – 1 : ISP's are SAIL, Tata Steel, and Vizag Steel Plant.

2 : Secondary includes mini blast furnaces.

**Table 2 India's crude steel production in H1 of FY'13 (kt)**

Product	Production for sale H1 of FY'13 (p)	% change over H1FY'12
Cold Pig Iron*	3138	5.76
of which ISP's	367	31.07
Secondary	2771	3.13
Less IPT / own consumption	49	11.36
<b>Production for Sale</b>	<b>3089</b>	<b>5.68</b>
Sponge Iron (DRI)	11690	(-) 8.81
of which ISP's	--	--
Secondary	11690	(-) 8.81
Less IPT / own consumption	1642	(-) 38.06
<b>Production for Sale</b>	<b>10048</b>	<b>(-) 1.18</b>
Finished Carbon Steel	39566	1.93
of which ISP's	8976	4.06
Secondary	30590	1.32
Less IPT / own consumption	4430	(-) 4.42
<b>Production for Sale</b>	<b>35136</b>	<b>2.79</b>

\*Surplus of steelmaking requirements supplied to foundries.

Source: JPC (P) = Provisional

**Table 3 Ferrous output for sale in H1 of FY'13 (kt)**

**Table 4 (Below): Sales and profits of some Indian steel companies in H1 FY'13 vs H1 FY'12 (Rupees X 10 million)**

Company	Net sales/income from operations INR x 10 million			Net profit INR x 10 million		
	H1 FH'13	H1 FH'12	% change	H1 FY'13	H1 FY'12	% change
SAIL	21303.93	21663.01	(-) 1.66	1239.52	1333.62	(-) 7.06
Tata Steel*	17854.39	15934.39	12.05	2707.37	3714.65	(-) 27.12
JSW Steel	17864.00	14690.00	21.61	1091.00	705.00	54.75
JSPL	9287.34	8346.77	11.27	1288.93	1824.33	(-) 29.35
Bhushan Steel	5395.55	4697.14	14.87	407.48	416.84	(-) 2.25
Monnet I&E	1066.60	855.72	24.64	139.79	150.09	(-) 6.86
Surana Ind	749.16	678.89	10.35	15.22	24.18	(-) 37.06

\*Tata's Indian operations only, excludes European and other overseas plants

## Consumption

Consumption of finished carbon steel, after adjusting for variations in stock and double counting reached 34.19Mt in H1 of FY'13, a growth of 4.37% over 32.76Mt in the same period of the previous year.

## Raw materials

**Iron Ore:** Indian steelmakers could not reap the benefit of falling global prices for ore in H1

FY'13 due to scarcity of ore at home and State owned miner, NMDC's new price mechanism from April, 2012 which has been based on the demand – supply situation instead of the export parity price. NMDC hiked the domestic prices of lump ore by 10% and that of fines by 8% in Q1 FY'13 with a further increase in Q2 FY'13, of 13% for lump and 8% for fines.

**Coal:** India's economic think tank CMIE has observed that the country's domestic coal supply 10

\*India Correspondent in Kolkata

# China's ore producers seek tax relief to combat imports

China imports about 60% of its ore as domestic mines have high operating costs due to low grade and often deep deposits. To improve profits and hence investment, the government is considering reducing the 25% tax levied to 10-15% but provincial governments are wary of this as they see their revenues falling and steelmakers fear the mines will not pass on any reduction in their costs. **By Shi Lili\***

THERE is news recently that the Chinese government is planning to reduce taxes for iron ore producers from the present 25% to 10 to 15%, although as yet there have been no concrete announcements by the authorities – the Ministry of Industry and Information Technology, the Ministry of Finance and the Tax Reduction Office of State Council.

Most ore producers in China are small scale operators unlike the large group enterprise typical of global ore producers. This makes them vulnerable in their market competitiveness. Also, their operating cost are high amounting to US\$90-100 a tonne which is two to three times higher than their foreign counterparts. China's ore miners are subject to various taxes such as value added tax, resources tax, etc which add up to around 25%. Thus, if the tax rate is reduced this will greatly help their profits.

But first, the conflict between supply and demand of steel has to be solved. Since early November 2012, daily crude steel output has been around 1.96Mt, which was raised by increased production by the major steel companies. But the demand for steel started to weaken with the coming of the winter season while production by steel mills has remained high. This conflict between supply and demand is becoming increasingly prominent and is driving steel prices down.

Under the gloomy economy, there are more calls from China's domestic iron ore producers to reduce taxes since such a policy would help protect the sustainable development of mines inside China and reduce the growing reliance on ore imported from foreign mining companies as well as restraining further exploration for iron ore and protect local resources.

Based on statistics from the China Iron & Steel Association (CISA), 1.1bnt of iron ore concentrate was required to produce the 700Mt of steel output expected in 2012, and 60% of this ore was imported. China's iron ore imports for the first 10 months of 2012 were 607Mt, an increase of 8 to 10% over 2011. The average import price was US\$131/t. The proportion of imported ore is expected to grow to nearly 70% in the future. Since there is fierce competition between domestic iron ore companies it is necessary to provide some favourable policies such as tax reduction to protect them from these imports.

Statistics from CISA show the iron ore price index in October 2012 was 331.44, an increase of 1.82% from the previous month. Although steel production has increased somewhat recently, the daily production has not returned to the highest point of 2012, but as steel supply continues to exceed demand steel prices will stay low and iron ore prices cannot therefore expect any rebound in the foreseeable future. Thus, any increase in demand for iron ore is limited.

Secondly, the winter season has start and will continue into Q1 2013. Based on the operations during the last three quarters of 2012, most Chinese steel mills could have expected to make good profits provided daily output did not exceed 1.90Mt. However, since daily output is currently 60kt in excess of this, most analysts believe that the whole industry will not change from its present loss making to profit in the coming months. And some even hold the opinion that it will be difficult to return to profit during the whole of 2013. The unprofitability of steelmaking is underlined by the fact that many steel companies operate other businesses as well as make steel and it is from these alternatives that any profit made is arising. Although there was a slight pick-up of prices in October 2012, the margin was not enough to make up for the losses suffered in the previous three quarters 2012.

According to its financial report, the return on sales for Masteel from January to September 2012 was a deficit of 3.1bn yuan (\$496M), and this did not include a 800M yuan (\$128M) outstanding debt. Several other large steel mills such as the Ansteel Group, Hualing Steel, etc are finding it impossible to return to profit. Therefore, the muted tax reduction from the government could be inspiring and bring confidence back to the whole steel industry.

Thirdly, it is expected that the policy of tax reduction would greatly lift the profit margin of ore producers in China. The production costs of Chinese iron ore mines are much higher than for most overseas mines.

The Chinese government is therefore considering the tax reduction policy to restrain the rising price of iron ore to steel companies. But there are also voices that say that while such a move might help reduce the price of iron ore it still would not reduce the demand for imported ore. Despite China being the largest iron

ore producers in the world with a run of mine output of over 1bnt a year, its iron ore is generally of low grade and has a high level of impurities. So, although China is the largest ore producers, much of its steel industry depend on imported ore.

But such a tax reduction policy may be opposed by some provincial governments since it involves the cutting of income to them. Also such a policy may only alleviate the tough situation ore producers find themselves in for a short period and would not fundamentally change the problem of the high production cost faced by Chinese ore producers as a result of low grade ore deposits many of which are also buried deep underground resulting in high exploration and exploitation costs.

Thus relieving taxes for ore producers will not reduce imports of iron ore since any decrease in tax will not greatly improve the competitiveness of domestic ore producers inside China in the long run. As the largest consumer of iron ore in the world, China's consumption in 2012 will be higher than the historical high of 686Mt in 2011 and two thirds of the world's sea borne volume are shipped to China each year.

As well as the situation of domestic ore producers not improving fundamentally through tax relief, profit margins are also squeezed by growing labour costs and environmental costs. Thus the present price of domestic ore is unlikely to be reduced by any forthcoming tax relief and most miners may simply use it to increase their profits.

Some analysts believed that it is difficult for China to develop its domestic mines as a means of reducing the country's reliance on overseas imports. Instead, some Chinese mining companies are taking ownership shares in overseas mines and negotiating off-take agreements to ship ore back to China. ■

## ◀ 9 Steel growth slows as industry flops in FY H1

is insufficient to meet the rising demand from the power, cement and steel industries. Therefore, India relies on imported coal. India's coal imports may rise by 28.3% to 127Mt. in FY'13. Over 50% of this will be coking coal, mainly used by steel plants. Though the global price of coking coal softened during H1 FY'13, the benefit was offset by the depreciation of the value of Indian rupee against the US dollar.

### Financial performance

Despite posting higher sales in H1 FY'13, most Indian steel companies recorded losses due to the following reasons:

- High cost of raw materials;
- High inflation;

- High rate of interest;
- Sharp decline in demand of automobiles, capital goods, white goods and other sectors;
- Continuing depreciation of Indian rupee against US\$;
- Lower earnings from exports due to the falling value of Indian rupee.

The only exception among Indian steel producers was JSW Steel which is one of the lowest cost global steel producers and sold a high percentage of value-added products during H1 FY'13. The company posted robust growths in net sales and net profits during H1 FY'13.

Sales and profits of some Indian steel companies in H1 of FY'13 as against H1 of FY'12 are shown in **Table 4**. ■

\*STI correspondent in China

# US network of river and coastal ports

With goods worth 33% of the US GDP carried by barge or ship, lack of investment in river infrastructure has exasperated the impact of last summer's drought but, East Coast ports are busy improving port capacity in readiness to accept larger ships following the completion of the widening of the Panama Canal in 2015. **By Myra Pinkham\***

WHILE still not back to pre-recessionary levels, volumes in and out of US ports have been improving and should continue to improve in 2013 now that the US Congress has come up with a deal that prevented the economy from falling over the dreaded 'fiscal cliff' on 1st January.

## Low water levels

Inland ports, however, are having a harder time than the coastal ports with the water levels on the Mississippi River still not recovered from this summer's drought. The flooding and winds from Superstorm Sandy did close some East Coast ports temporarily, but did not have much of a long-lasting impact, nor did it help the United States' inland waterways, where, according to Sandor Toth, publisher of the River Transport News, operating conditions are not getting any better, but are actually getting worse. "While there has been a lot of rain on the East Coast, it hasn't been falling where it is needed," he explains.

"Making it worse, the US Army Corps of Engineers has reduced the flow of the Missouri River, as is required by law," Toth says. "That usually isn't a problem, but with water levels so low it has had a severe impact on the Mississippi River.

The drought has caused more costs to the ports, notes Dennis Wilmsmeyer, president of the Inland Rivers Ports and Terminals trade association as well as executive director of America's Central Port, Granite City, Ill. He says that the ports have been dredging constantly since around July and for the most part have been able to keep channels open, but only by lightweighting barge loads. "For each one inch drop in the water level, you need to lightweight barges by about 17 tons of freight," he explains.

Certain sections of the Mississippi River could be closed to commercial traffic by mid-December, particularly that between St Louis and Cairo, Ill. The American Waterways Operators and the Waterways Council Inc trade associations said in a joint statement, "Of particular concern are hazardous rock formations ... (that) threaten navigation when water levels drop to anticipated, near historic lows." They add, "The rock formations, combined with the reduced flows from the Missouri River, will prohibit the transport of essential goods along this critical point in the river, effectively stopping barge transportation on the middle of the Mississippi River around December 10."

Wilmsmeyer says that while it does tend to be 'feast or famine' – floods or droughts – on the inland waterways, "all in all the river system runs well. Barge transportation remains the cheapest, most efficient mode of transportation, especially for bulk commodities," he says.

John Vickerman, president of Vickerman Associates, Williamsburg, Va, says that there are some new developments that could infuse new



**America's Central Port North Harbor Granite City Illinois**  
Pic credit Bill Stahlman for America Central Port



**For every inch the water drops 17 tons of cargo cannot be carried**  
Pic credit Mark Kemp for America Central Port

vitality into the inland waterway system, including the need to transport more pipe and tube given the increased development of the nation's oil and natural gas shale plays, especially the Marcellus Shale and the Utica Shale. Also, he notes, that with the Great Lake Commission looking to put in dams to prevent the migration of the Asian Carp, there have been proposals to put ports at each of the dam sites. Even the widening of the Panama Canal in 2015, which is generally seen to possibly be a boon for the coastal East Coast and Gulf of Mexico ports, could also benefit the Mississippi River ports as well.

## Infrastructure funding

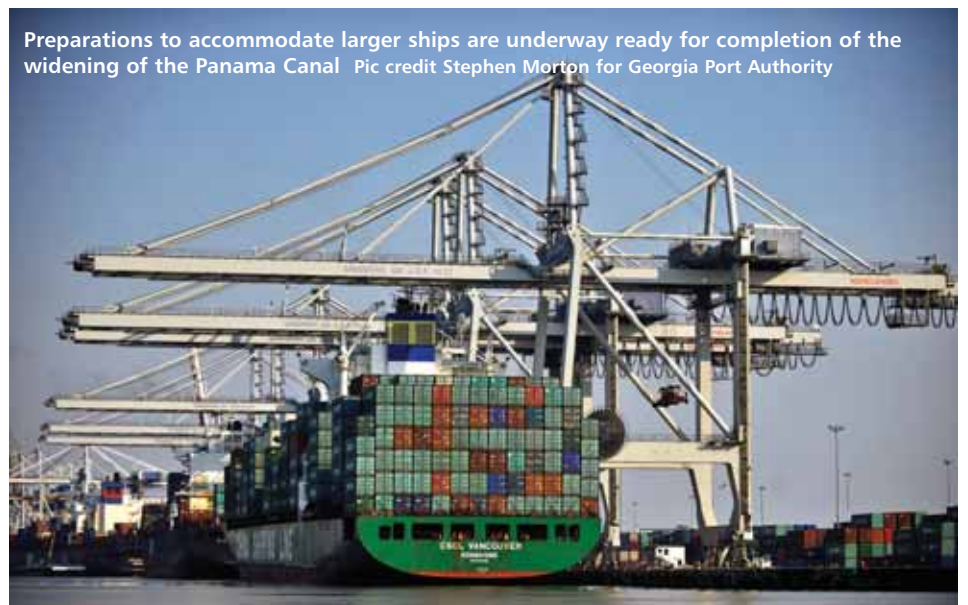
Nevertheless, Vickerman says the inland waterway ports have, by enlarge, not kept pace with the need for locks and dams, but have just been making the necessary repairs to meet their emergency needs.

One problem for all ports – not just the inland

ports – has been the lack of outside funding. "Federal funding for jobs has been historically non-existent," Wilmsmeyer declares, which is a problem given that states are currently, largely, very cash strapped at the edge of deficit.

The most federal funding in recent years has been through the US Department of Transportation's popular TIGER (Transportation Investment Generating Economic Recovery) grants programme, which has been part of the American Recovery and Reinvestment Act, or economic stimulus programme passed in 2009. "The TIGER grants have been a real help to ports upgrading their facilities," he says.

A handful of ports, including Jacksonville, Fla, and Charleston, SC, have received funds from the Obama administration's 'We Can't Wait' policy initiative launched in October 2011 to institute policies by executive orders and administrative rulemaking and recess appoint-



**Preparations to accommodate larger ships are underway ready for completion of the widening of the Panama Canal** Pic credit Stephen Morton for Georgia Port Authority

\*US correspondent



**An upturn in transporting OCTG is being experienced thanks to shale gas exploitation** Pic Credit Port of New Orleans

ments in response to the Congress' unwillingness to pass economic legislation, especially in the gridlock that occurred during the 2011 debt ceiling crisis.

Especially since the US port system accounts for moving approximately a third of the US GDP, or about \$5tr to \$6tr per year, the Falls Church, Va.-based American Institute for International Steel says more should be done to support it.

In a recent newsletter the AIIS states, 'America's harbours and navigable waterways are essential to the economic health of the country, yet they are becoming increasingly narrowed and silted up, reducing their carrying capacity and increasing the cost of moving cargo. Jetties are collapsing and breakwaters are aging dangerously. Both funds to pay for (the Harbor Maintenance Trust Fund) and the capacity to dredge and maintain (by The Army Corps of Engineers and private industry) this necessary infrastructure exists (but) Congress has not only failed to appropriate adequate funds for these purposes, but has routinely used un-appropriated Harbor Maintenance Trust Fund (HMTF) funds for unrelated purposes.'

For this reason the AIIS supported the 'Realize America's Maritime Promise' (RAMP) Act introduced in the US House of Representatives by Rep Charles W Boustany Jr (R-La), which would require the full HMTF, plus any interest earned on the fund balance, to be distributed in full each year for the purposes (primarily dredging) specified in the original HMTF legislation, as is the practice required for the Airport and Airways Trust Fund.

Vickerman says that this situation has led some port authorities, who in the past funded their infrastructure improvement projects privately, to seek out private funds. For example, container ship line Maersk's APM Terminals Inc, headquartered in Copenhagen and operating marine terminals all over the world, has submitted a multibillion dollar unsolicited proposal to run the Virginia Port Authority's terminals for a 48 year term. There are some concerns

about this deal, which is still under evaluation by the state government and the port authority, Vickerman says, as it is uncertain how competitor cargo lines will react. "It could change the atmosphere of the port," he says.

### Growing volumes

In general the nation's ports have seen volumes increasing both into and out of their ports ever since the recession ended. In fact, Vickerman says a 260% increase in global container trade (and probably a comparable increase in break bulk) is possible by 2025. As far as transpacific trade, he predicts that imports will triple from 2009 to 2025 while exports will double. Meanwhile transatlantic imports and exports will both just about double in the same time-frame.

The dynamics of the flow of freight in general, including that of steel and steelmaking raw materials, vary from port to port and the markets they serve.

Jacksonville, for example, had seen steel volumes, including those for wire rod, beams and angles, under pressure ever since the economic downturn, largely because of the impact of the construction sector on the port, Rick Sharp, vice president of customer service and business development for Seonus, which operates a terminal that specializes in part in steel products at Jacksonville's port. "Only recently has there been a little increase in the construction sector, resulting in increased import volumes, especially as prices stabilize."

He says it is only recently that companies are willing to bring in a little more inventory and that banks are being a little more lenient about their borrowing policies. "Break bulk traders are saying that they are getting more purchase orders and that it will likely increase further once domestic mills start to feel better about their business."

Alison Skipper, a spokeswoman for the South Carolina Ports Authority, says that there was been a very positive upswing in both imports and exports in the Port of Charleston due to a very successful manufacturing environment. A lot is due to the growth of the automotive industry (BMW has a plant located in the area), she says. But there has also been a lot of growth in the power generation sector. "Many gas turbines for power plants are now being built in the United States," she says.

Robert Landry, chief commercial officer for the Port of New Orleans, says that while they have moderated some in the second half, volumes as a whole have been up year on year. He

attributed increased drilling in the nation's shale plays for some of that. "That has not only driven demand for imported pipe, but also the hot rolled coil and plate that are used to make that pipe."

Marcel Van Dijk, business development manager for the Port of Los Angeles, says that volumes are definitely climbing out of the hole that they were in during the economic downturn. Like Landry, he attributes that to the oil and natural gas market, given the strong drilling active the Dakotas. "Also one of our biggest customers, California Steel Industries, has been bringing in more slabs," he says.

Wilmsmeyer says that while steel transportation through Granite City was fairly flat this year, there was good growth in volumes of coal and iron ore pellets.

### Panama Canal widening

There are mixed views as to what the impact will be for the East Coast and Gulf of Mexico ports once the expansion of the Panama Canal is completed in 2015, enabling the larger Post Panamax ships to call upon those ports. "Some people believe that it could be a Y2K kind of situation, with not much of an impact," Vickerman explains. "But I think the future will be rosy, especially for container traffic," he says.

Nevertheless, many East Coast and Gulf ports are in the midst of improvement projects aimed at enabling them to take advantage of this potential new business. Meanwhile some West Coast ports are also in the midst of infrastructure improvement projects to ensure that they remain competitive. The Port of Los Angeles, for example, just completed a 10-year channel deepening project that involved the dredging of its main channel and is in the midst of a \$1.2bn infrastructure improvement programme even though Van Dijk plays down the likelihood of losing much business, especially break bulk business.

"Break bulk tends to be more 'local'," he explains. As far as container traffic, "If cargo is sourced from Asia, we will continue to be the place of discharge, even after the Panama Canal expansion. Transportation costs are too high."

Also, according to Daniel Yi, a spokesman for the Port of Long Beach, says the new generation of transpacific ships will be too big to pass through even the upgraded Panama Canal. Although he does admit that some traffic will be going to the East Coast, he hopes that it will be limited given the huge amount of infrastructure that is already in place in Southern California.



**Loading coil at the Georgia Ports Authority wharf** Pic courtesy Russ Bryant

# ITL integrating transport and logistics in the USA

In 15 years US logistics company ITL has increased its warehouse capacity 60 fold as it expanded its handling facilities from optimising container use to river barge, rail and road transport. Throughout, sustainability has been at the fore of operations with a geo-thermal temperature controlled warehouse in Chicago and a fleet of trucks ready to meet the EPA's Class 8 regulations. **By\* J Roetter & T Kay**

WITH extensive backgrounds in both international and US domestic supply chain logistics, International Transload Logistics (ITL) founders John Roetter and Miles Douglass identified a 'need' and an 'opportunity' to serve the requirements of the steel and other heavy industries.

Starting in 1998 with an idea and a 10kft<sup>2</sup> (929m<sup>2</sup>) warehouse facility in Chicago, IL, the team approached the international shipping community with a bold and innovative, yet simple concept.

Using their knowledge of the US intermodal rail network and the on-dock rail capabilities of certain container lines, the ITL founders 'revolutionised' how containerised steel and steel products, as well as other commodities were transported.

The premise was simple:

- Private (ITL) gate privileges enabled interchange IN/OUT at several rail yards;
- Allow shippers to take full advantage of the name-plate capacity of the container;
- Increase payloads on 40 foot (12.1m) containers from 44k lb (then the US legal max for road transport) (19.95 metric tonnes) to 58k lb payload(s) (26.3t) permissible on barge and rail.
- Reduce the number of containers shipped from four to three by maximising loads; and
- Lower supply chain costs by up to 25% or more.

This innovative platform created the ability for ITL to unload the much more commonly used standard 40' containers using the necessary attachments versus unloading open tops which requires specialised handling, attract additional charges and are in short supply.

This further reduces unit cost, enhances the availability of containers and expedites transit of heavy or dense cargoes.

Since embarking on this logistics experiment and supply chain solution, ITL has grown and continues to expand its range of services and

**Steel cargoes originating out of the Gulf of Mexico feed into the Midwest off the Mississippi River system**



cargo handling capabilities and client diversity, increasing the types of cargo handled.

In addition to its speciality of handling steel and steel products, ITL now stores and handles a wide range of goods, including those for: aerospace, automotive, locomotive and agricultural components and assemblies.

Since opening its first 10k ft<sup>2</sup> warehouse in 1998, ITL now operates four warehouses across two states (Illinois & Kansas), with a total area of 600000 ft<sup>2</sup> (557.418km<sup>2</sup>) of storage under cover. ITL has strategically located these facilities immediately adjacent or in the proximity of the Chicago/Kansas City and Midwest markets and the largest US inland intermodal ports trans shipping to the BNSF and UPRR rail networks. These intermodals have a 'combined' annual lift capacity in excess of 2 million containers.

To add to this, ITL's warehousing and transload facilities fall within two miles of the Des Plaines River and the Joliet Regional Port District (Chicago). The Des Plaines is a tributary of the Illinois and Mississippi River. ITL has experience working dedicated barges for carrying steel and welcomes opportunities to assist customers with steel cargoes originating out of the Gulf of Mexico feeding into the Midwest off the Mississippi River System. With a strong foundation in transporting steel, ITL handles virtually any type of cargo, from steel pipe, tubing, stainless steel, plate, sheet and coils as well as other products such as lumber, hardwoods, tile and heavy machinery and a wide array of consumer goods. While container traffic is growing on the river, the majority of barges presently used have the cargo accommodated in the barge hold.

In 2005, to further service the growing business, ITL added an intermodal trucking division called 'Transport One' with a full complement of tractors and heavy haul chassis to carry out final delivery and pick-up. In anticipation of the new Environmental Protection Agency (EPA) regulations governing heavy trucks (Class 8), scheduled to commence in 2014, ITL continues to invest in new technologies and equipment, with the dual goal of improving fuel efficiency and further reducing greenhouse gas (GHG) emissions. This is in line with the broader and tighter scope of the CAFE regulations, including heavy duty truck (HD sector) benchmarks. ITL's Transport One delivers to the greater Midwest region, including the states of IL, IN, WI, IA, MI, KS, MO, OH, KY and beyond. Some of ITL's services include, but are not limited to:

- Transloading
- Warehousing (including speciality steel storage in a geo-thermal heated facility)
- Packaging & Crating
- Pick & Pack
- Blocking & Bracing
- Fork Lift Service using 50+ fork trucks with capacity from 5k to 40klb (2.26t-18.1t)
- Warehouse Management System (WMS)
- Load Adjustments (Distressed loads)
- Transportation
- Flatbed Delivery
- Permitting
- Gated & Electronically Monitored Facilities and
- Secure Reduced Rate Container Storage.

In support of customers' needs, ITL continues to make significant investment in facilities and technology. In October 2012, the company expanded its storage footprint to 600 000ft<sup>2</sup> including an additional 200kft<sup>2</sup> of warehousing in Chicago located directly across the street from the Norfolk Southern Landers, intermodal ramp. It also enlarged its geo-thermal heated facility by 112kft<sup>2</sup> and serves railroads operated by Norfolk Southern Railroad, CSX Railroad, Canadian National Railroad, and Canadian Pacific Railroad.

The geo-thermal heating and cooling system (type R37) at the Landers warehouse uses insulated panels below ground and in the ceilings to trap the earth's ambient temperature radiating through the slab floor to the warehouse space above. By tapping into the earth's relatively constant ambient temperature of 50-55°F (10-13°C) ITL is able to maintain a warehouse temperature of approximately 60°F (15.5°C) in winter and 85°F (29.5°C) in summer so pre-18



**The modern fleet of trucks are ready to meet the EPA Class 8 emission standards**

\*International Transload Logistics, Inc

# Improved power collector for wing trippers in raw material handling plant

The installation of Cable Reeling Drums to supply power to the Wing Trippers at Durgapur Steel Plant has eliminated downtime previously suffered on account of breakdowns in the former rail current collecting system employed. This modification has achieved a 16% increase in the amount of screened lump ore fed to the blast furnaces.

By TK Dutta\*, AK Verma\*, SA Balaji\*, PA Aneesh\*, S Chaudhuri\*, SK Ray\*, SK Bhaumik\*\*, AC Nigam\*\*, T Puranik\*\* & G Krupavaram\*\*

THE original area of the Raw Material Handling Plant (RMHP) at Durgapur Steel Plant, India has wing trippers for stacking the raw materials. Power was fed to these wing trippers from current collecting rails (copper bus bars) located at ground level. Frequent breakdowns in the collector system was causing delays as well as incurring demurrage costs due to interrupted upstream tipping operations. The wing trippers 1 & 3 were modified to each incorporate a wheel mounted extended platform on which was mounted a Cable Reeling Drum (CRD) which has resulted in the elimination of breakdowns, streamlining of tipping operations and an increase in productivity and quality.

The Raw Material Handling Plant (RMHP) of Durgapur Steel Plant (DSP) produces and supplies the required blend for the sinter plant, also fluxes to a new lime calcining plant and screened lump iron ore to the blast furnaces. The raw materials are received at RMHP in railway wagons from various mines. These materials are tipped at the RMHP. Moreover, RMHP also receives coke from the plant's coke ovens and a few reverts generated as by-products from downstream processes.

The RMHP is divided mainly into two areas namely 'old' and 'new'. The old area consists of three wing trippers and four reclaimers. The wing tripper travels on rails between stockpiles in the stockyard and has one main conveyor to carry the different ingredients and two auxiliary conveyors extending laterally on both sides of the tripper to provide a wider and more uniform distribution of bulk material as they are discharged.

Power at 415 volts was fed to the wing trippers from current collecting rails (Cu-bus bars) stretching over a length of 375m. These current collecting rails were positioned at ground level beneath the walking platform. This made them difficult to access for maintenance. As a result, repair of breakdowns generally took some time. Hence, the stacking rate in the old area was less than the desired quantities.

During a breakdown period, upstream tipping was also adversely effected which led to demurrage charges as the return of empty wagons was delayed.

To overcome these constraints, it was decided to incorporate a cable reeling drum to supply power to each wing tripper #1 and #3 in a wheel mounted extended platform integrated into the wing tripper platform and to dispense with the existing power collecting system of copper bus bars.

## Status in SAIL Plants

Extensively, electrical supply at 3.3kV has been adopted for the Cable Reeling Drums at RMHP Durgapur. This high voltage level was chosen mainly to reduce the cable diameter needed thus reducing the size of the cable reeling drums required. Previously, 415V had been used on the collecting rails in the old plant.

Comparing the power feeds to other SAIL group plants, the ore bedding and blending plant at Rourkela Steel Plant use a cable reeling drum to power the transfer car which carries yard machines such as stackers and re-claimers. This operates at 415V. The distance travelled as well as the motor capacity are far less than that at the RMHP Durgapur Steel Plant.

Also, in the ore handling plant at Bhilai Steel Plant there are four Twin Boom Stackers, a number of Bucket Wheel Reclaimers and three Barrel Reclaimers. All the equipment there is powered through Cable Reeling Drums which handle cable carrying 6.6kV which feeds step-down transformers to 415V, mounted on each car.

## Approach

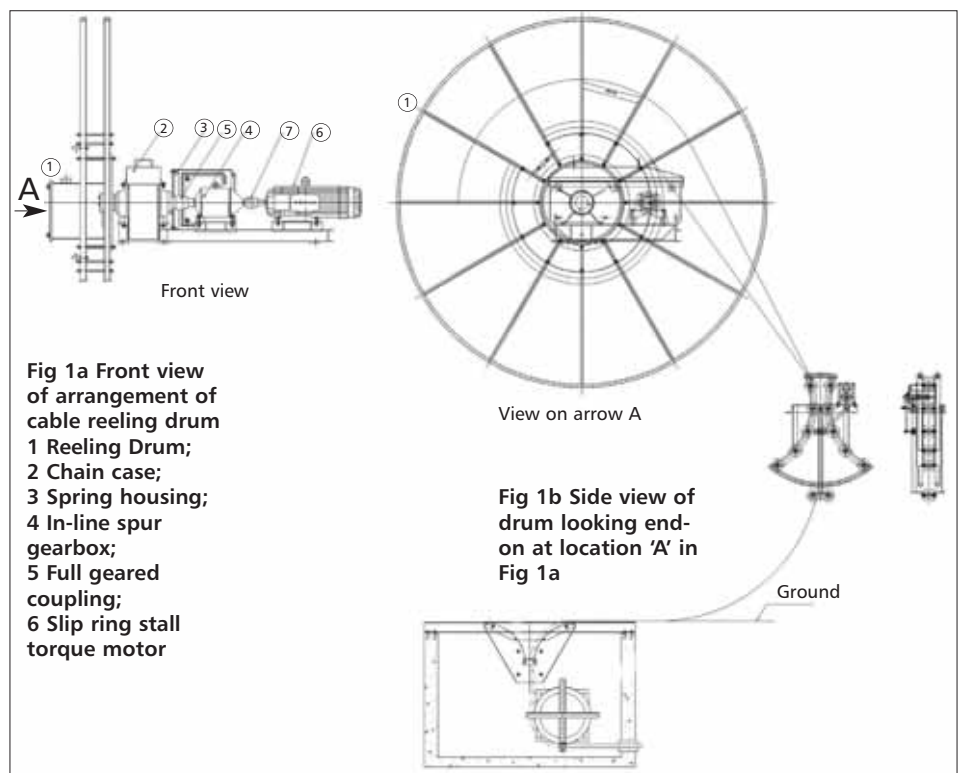
A study was launched to determine the average time taken to repair a failure of the current collector in the old area of RMHP Durgapur. These are located at ground level and concealed by steel sheets. The system was studied to collect useful information and data to select the best locations for the proposed cable reeling drums. Three alternative locations were explored for the Cable Reeling Drums (CRD) for the wing trippers at RMHP:

1) At one end of the tripper travel length, near the existing power feeding point, but this could have led to excessive stress in the cable and abrasion from the ground when laying. Also, a higher motor power for the drum would be required.

2) Another location was to mount the reel on the tripper just below the transfer chute by extending the existing structure and using the existing power feeding point at the end of the maximum length of travel. Here again, this would necessitate a more powerful drum motor and a larger diameter cable reeling drum to accommodate a full bed length of cable.

3) A location at the front of the wing tripper near the operator's cabin could be achieved by extending the existing platform which would result in a more stable system, easier to implement and offering greater ease in laying the cable. The feeding point for the power could be kept at the midpoint of the tripper travel to optimise overall system requirements and minimise cable length.

On evaluation of these three possibilities, number 3 was adopted and the design and



implementation of the various components for the new system and implementation of the system commenced.

The time to fully implement the system was seven months.

### Design Basis

The suppliers of the cable reeling drums and driving motors were selected and work carried out to extend the platforms at the front of the wing trippers. The design requirements are summarised in **Table 1**.

### Commissioned system

The system broadly includes the Cable Reeling Drum, Stall Torque Motor, Slip Ring Housing, Limit Switch, Strain Relieving arrangement, Cable Guide, Gear Box, Resistance Box, Turn Over Anchor arrangement with RCC pit, Cable Guide and clamps to take trailing cables to the reeling drum (**Fig 1a**). The details are described below:

### Cable reeling drum

The Cable Reeling Drums (CRD) are stall torque motor driven semi-parallel type fabricated from mild steel and are large enough to accommodate the entire length of the cable and suitable for bi-directional cable payout and rewind. The CRD is of the centre feed type wherein the machine travels on both sides of a fixed point where a turnover anchor is located thus facilitating travel of the tripper equal to twice the cable capacity of the reel.

The cable reeling drum's centre line and orientation is aligned to lay the cable in the space between the rail and conveyor table at an appropriate distance from both.

A guide to assist cable payout and rewind in both directions is provided. Appropriate interlocks of the CRD with the wing tripper have been provided. A cable strain relief arrangement to relieve strain on the cable terminations is included.

A mechanism to ensure proper layering of the cable side by side across the width of the reel drum, and then overlapping of subsequent layers after completion of a layer is provided. This includes a tension/ under-tension protection switch mounted on the guide arrangement as shown in **Fig 1b**.

### Mounting

The cable reeling drum is mounted on an extended platform on the wing trippers on the operator's cabin side. The power tapping point (Junction Box) is installed in the middle of the total travel length of 374m. The cable reeling drum is designed to accommodate 200m of cable of size 3½ x 70mm<sup>2</sup> plus two dead turns (DT). At this location the drum can smoothly payout the cable as the wing tripper moves either side of this centre point to the limit of travel. The structural arrangements are shown in **Fig 2**.

### Drum motor

The speed of a Stall Torque motor drops as it is loaded and reaches zero. At zero speed if the shaft of the motor is further rotated by a force in the opposite direction of normal operation then the torque motor resists this. This property of a torque motor exactly suits the needs of reel unwinding. The stall torque motor is of the slip ring type, operating at 415V, 3-phase with an output torque of 26.5Nm. It has an in-built brake. The slip ring housing is provided with a suitable brush gear assembly.

Parameter	Specification
Altitude above sea level	Less than 1000m
Relative humidity	90% max
Ambient temperature	50°C max
Voltage	415V, 3 phase, 3 wire
Frequency	50Hz
Control voltage	110VAC through separate control transformers
Type of reel drum	Semi-parallel having arrangement to lay cable uniformly on the reeling drum
Type of driving motor	Squirrel cage stall torque induction motor
Output power of motor	30 Nm max
Resistance type in resistance box	Punch grid type
Trailing cable	3½ x 70mm <sup>2</sup> EPR trailing
Cable length on drum	200 meters +2 dead turns (DT)
Weight of Ethylene Propylene Rubber (EPR) trailing cable	4.9kg per metre
Total travel length	374 metres max
Type of feed	Centre feed
Type of pay out	horizontal
CRD mounting	On extended wheel mounted platform integrated to the tripper
Machine speed	15m/min (idle) and 0.02 to 0.2m/min while stacking

**Table 1** Parameters of operation of Cable Reeling drums at Durgapur

### Tension monitoring limit switch

The cable reeling device is provided with a tension monitoring limit switch to control the tension on of the cable. The switch is a rotary

geared adjustable cam type. The switch is operated by a swivel arm which is rotated by means of a cam fitted to the reel spindle. When the reel revolves during pay-out of cable, the arm is moved until it opens the contacts in the limit switch de-energizing the motor. In the pay-in condition, the arm is rotated away from the limit switch making the contacts and so energizing the motor.

### Cable guide/deflector

The Diabola type cable guide assembly consists of pulleys and rollers fitted with anti-friction bearings mounted near the drum. These ensure that the trailing cable while being reeled in or out will be bent at a safe radius to ensure parallelism with the ground for safe cable laying.

### Gear box

A gearbox provides a ratio of 34.6:1 between the drive motor and the cable drum for the necessary speed matching.

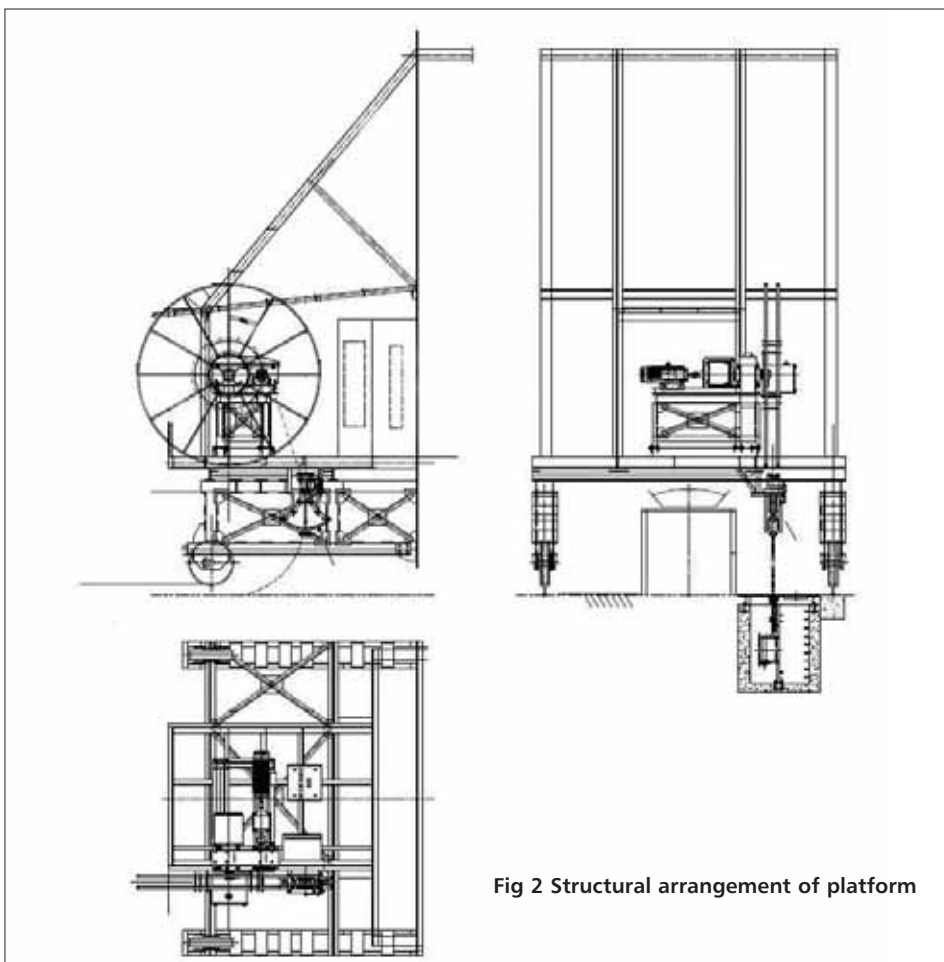
### Resistance box

A punch grid type resistance is provided for the slip ring stalled torque motor for speed control and dissipation of heat energy.

### Turn over anchor

The turn over anchor arrangement anchors the cable at the centre of travel and facilitates cable laying out in both directions from the midpoint of the length of travel. The arrangement is bi-directional as the laying of the cable during pay-out reverses direction at the midpoint of the length of travel of the wing tripper. An arrangement for two idle turns of cable on the drum is provided to avoid transmission of cable tension to the power junction box.

18



**Fig 2** Structural arrangement of platform

## Extended tripper platform

The platform on which is mounted the cable reeler is a wheel mounted extension at the front of the tripper. This moves on the tripper tracks and was designed keeping various considerations in mind including the stability of the wing tripper after incorporating the extended platform, space availability for mounting the equipment, access for maintenance etc.

The paramount requirement was to design a structurally rigid platform extending from the tripper. The platform needed to be stable, robust, and lightweight. It had to accommodate all the reeler equipment including a pedestal for the Cable Reeling Drum, the CRD itself with motor, slip rings, stall torque motor, cable, resistance boxes etc.

The total weight of this equipment plus the weight of the platform would give rise to a turning moment on the tripper structure if not self supporting. This required the provision of a pair of wheels on the extension to take the additional load of the new equipment and counter the turning moment and provide stability to both

the extended platform and wing tripper. The extended platform is located on the operator's cabin side and is fabricated from mild steel of adequate strength. It is supported on two wheels 715mm diameter and the platform is integral with the main body of the wing tripper.

## Electrical panel

The cable reeling drums are provided with an Electrical Panel to feed the power. These are floor mounted fixed and free standing. A suitable enclosure made of structural steel and steel sheet is provided to protect the panels and other associated electrics against the hostile environment. The cable entry is from the bottom through a double compression cable gland.

## Trailing cable

The 1100 volt grade trailing cable is of size 3½ core 70mm<sup>2</sup> containing an annealed tinned copper conductor covered with ethylene propylene rubber (EPR) insulation. The cable is reinforced with nylon cord between the EPR and an outer sheathing of Polychloroprene (PCP).

## Work schedule

The entire erection and commissioning work was carried out in phases to achieve minimal shutdown time and leave production of the plant unaffected. The erection and commissioning work was carried out first for wing tripper #1 and then in wing tripper #3. Wing tripper #1 with cable reeling drum was put into regular operation on 26th April, 2012 while wing tripper #3 with its cable reeling drum was put into operation on 28th June, 2012, to the satisfaction of operating and maintenance personnel of RMHP. ■

## Acknowledgement

The authors express their gratitude to the management of Durgapur Steel Plant and Research & Development Centre for Iron and Steel for taking up the implementation of this new method of supplying power to the Wing Trippers in the old area of RMHP, Durgapur steel plant and granting permission to publish this paper.

## 13 US network of river and coastal ports

The New York-New Jersey Port Authority is spending a total of \$2.5bn on improvements in preparation for the Panama Canal expansion, including the second phase of its harbour deepening project that will dredge key channels to a depth of 50 feet. It is also raising the Bayonne Bridge, as the current 151 foot air draft restriction beneath the bridge is seen as an obstacle for larger ships looking to do business with marine terminals west of the bridge in Newark and Elizabeth, NJ.

The Port Authority of Houston is continuing to build out its Bayport, Texas, facility and retrofitting its Barbours Cut facility so that it can receive larger vessels as well as deepening the channel at both terminals to 45 feet. "We are already the deepest harbour on the Atlantic Coast so we are already positioned to handle the larger Post Panamax ships," Skipper says. Nevertheless, the South Carolina Ports Authority is in the midst of further deepening its port as well as making other capital improve-



ments to enable it to increase its container capacity by 50% by 2019.

Some East Coast ports, such as Jacksonville, already have large ships from the Suez Canal calling on them. "Because of that the expansion of the Panama Canal is almost secondary for us," Nancy Rubin, a spokeswoman for the Jacksonville Port Authority, says.

Generally US ports are optimistic that 2013 will bring yet more volumes. "It has been a long time that volumes were down," Alberto Cabrera, Jacksonville Port Authority's director of cargo sales and marketing, says. "I'm very excited about what next year will bring. It has been a long road up." ■

**Both imports and exports have experienced a positive upswing in the Port of Charleston**  
Pic credit South Carolina Ports Authority

## 14 ITL integrating transport and logistics in the USA



**The geo-thermally heated warehouse in Chicago for storing special steels**



venting large temperature swings, common in most general purpose warehouses. There is a supplemental heating/cooling system, but it is rarely required and only in the most severe of weather conditions. This minimises the

freeze/thaw effect that can damage or negatively affect the appearance of some cargoes and creates an ideal environment for those commodities prone to the adverse effects of condensation.

ITL's technology includes the recent purchase of a sophisticated warehouse management system which enables efficient and reliable inventory handling. The WMS provides electronic data interchange (EDI) for customers to optimise inbound and outbound processing times along with a web portal to give customers the visibility on orders and inventory. Radio Frequency scanning is used to eliminate errors in shipping and processing. As ITL grows it continues to seek out the best technology and equipment available. Through this investment ITL is able to provide its customers, continual improvement in material management an expanded range of services at a cost competitive edge. Whatever the Steel business and however unique the cargo handling need, ITL has the 'Solutions that Move you' in the right direction. ■

## Contact

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Replacing old and unreliable self-propelled transporter units with a tractor and articulated trailer combination at Tata Steel IJmuiden has increased the load carrying capacity, reduced maintenance costs 20% and improved fuel economy by 25%.



Fig 1 Tight corners have to be negotiated around the site

## New vehicle combination speeds up material flow and lowers operating costs

TATA Steel (Europe) has been a client of IJmond Transport Groep BV for many years. Within the scope of this cooperation, the company is in charge of the development of the internal material transportation at Tata's IJmuiden site in The Netherlands.

The harsh operating conditions of a steel works is not without consequences resulting in the availability of the heavy vehicles needed to transport coils and raw materials being unable to reliably meet demand.

This meant that new transport equipment had to be obtained. Using vehicle combinations consisting of tractor units and heavy translifters the material flow now runs smoothly and reliably once again.

Since the founding of the company in 1946 the IJmond Transport Groep has developed into one of the largest dedicated in-plant translifters of steel and other heavy and special transport tasks.

At Tata Steel IJmuiden the company is in charge of raw material transport, internal transport and express-services. About 3Mt of finished steel is moved each year.

Previously, internal transport was managed with the help of six elderly self-propelled vehicles. These had to cover distances ranging from just 250m to 5km carrying load of up to 120t. As is usual in the steel industry, transport needs to be ready for use around the clock.

### Call for action noted

Using these old transporter units acquired over the years, IJmond was no longer capable of handling the logistics efficiently and professionally. Due to frequent hydraulic problems and the complex technology in the self-propelled vehicles, maintenance costs increased to a relatively high level. Furthermore, the drivers complained about the poor ergonomics of the old vehicles with seats that caused back problems resulting in occasions of sick leave.



Fig 2 The driver's cabin is ergonomically designed and its suspension protects the driver on the rough roads around the works

With this background, IJmond's management saw that it was time to take action. There was no way around the problem but to renew all the existing transport system.

### New translifters

Finish firm TTS Liftec Oy, a specialist in the provision of heavy translifters already had references in the steel industry, and could offer suitable vehicles for the task.

IJmond recommended a combination of a Terberg Tugmaster tractor unit and a heavy transliifter (type TTS LIFTEC LTH130H) as the best solution to meet the need.

Before IJmond would commit, however, TTS Liftec had to convince them that the system was sufficiently manoeuvrable around the steel-works because of the length of the combined tractor and trailer. Any lack of manoeuvrability would create problems because the layout of the work area at Tata Steel in IJmuiden which has a number of tight turns.

To clear any doubts TTS Liftec brought a transport unit to IJmuiden for test purposes. The tests in the work area was satisfactory, but before an investment decision was finalised IJmond wanted to talk with a user of the translifters. Thus they visited Outokumpu, a longstanding client of the Transliifter in Tornio, Finland. The operating conditions of both of the companies are very similar. The IJmond management were convinced of its suitability and the benefits during the visit and the transport equipment was soon placed on order.

### A flexible combination

Today, IJmond's motor pool consists of four heavy translifters type TTS LIFTEC LTH130H, four Terberg-Tugmaster tractor units and 28 transport pallets for collecting coils. The empty heavy translifters each weigh 24 tonnes include a system to lift on the loaded coil pallets, and have a load carrying capacity of 130 tonnes. The



Fig 3 Covers have been designed to protect the coils from bad weather

load carrying capacity has been increased over the previous system as the weight of the pallets is reduced from the previous 20t to 10t. This provides greater capacity on the transliifter to carry more coils on each journey.

The lifting bogies in the sturdy framed transliifter have suspension which improves the stability of the vehicle. This also helps make the transport routes safer (Fig 1).

The tractor unit is equipped with a comfortable ergonomically designed cabin (Fig 2). The suspension makes the ride shock-free and vibration-free a particular asset as the work's roads are in a poor condition. The driver has good all-around visibility, an important consideration for safe working. Furthermore, the modern diesel motors of the tractor units are very quiet so the noise level in the cabin is low. All in all, the driver can concentrate on the job and does not tire so quickly.

The tractor units and heavy translifters are built with standard components which have being used and developed over the years. This makes the combination durable and reliable. IJmond says that maintenance costs are reduced by 20%. In addition, fuel consumption is 25% less than before.

TTS Liftec was able to convince the operator not only of the quality of their product but also of their problem solving ability. For example, to increase the driving stability the engineers at TTS changed the dimensions and the steering geometry of the vehicle according to the needs of the site. In addition, the height of the transliifter is about 300mm lower than with the old transport system which increases the stability of the loaded vehicle by lowering the centre of gravity.

To avoid the influences of weather on the steel coils, a cover for the transport pallets was developed (Fig 3). Two such weather covers have been supplied to the transport unit in IJmuiden.

The after-sales service has impressed IJmond. Wim Strijk, Managing Director of IJmond Transport Groep comments: "Within 24 hours all the necessary parts are here from the LIFTEC central storage warehouse. Because of this high availability we don't even consider using another spare part supplier."

This new transport system has been in use for nearly three years now. IJmond have already bought additional translifters for other transport assignments. ■

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# Experimental assessment for the characterisation of thin slab casting mould flux

This paper analyses the differences in parameters required when selecting a mould flux for a thin slab caster compared with those for a conventional caster, concluding that a lower melting point is required to ensure lubrication continues as the cast steel shell proceeds down the steeper temperature gradient experienced in a thin slab mould.

By\* S K Gupta, A Chatterjee, N Pradhan, J Prasad & S Ghosh

THE expansion plan of Bokaro Steel Plant of SAIL envisage the introduction of energy efficient technologies such as thin slab casting. A new steelmaking complex is being planned with an installed capacity of 3.8Mt/y of crude steel. Thin slab casting is a direct extension of conventional continuous slab casting (CC) of slab. It uses a funnel shaped oscillating mould of high aspect ratio (width/thickness ratio of slab) in order to cast slabs 40 – 100mm thick at a high casting speed of 4-6m/min. The initial solidification of the steel shell is similar to that of a conventional CC. However, in thin slab casting the shell passes from the upper funnel section of the mould to the lower parallel section with its high aspect ratio at a high casting speed.

The control required for thin slab casting is more stringent than that for a conventional thick slab caster; hence the selection of the properties of the mould flux used is critical. To select a flux for high speed thin slab casting the properties of the mould flux, namely viscosity of the molten flux, its melting trajectory, the melting rate and type of free carbon have been investigated and characterised in comparison to fluxes used in conventional continuous casters. It was concluded that for thin slab casting, the flux should have a low melting temperature and be less viscous at low temperatures. A flux with a high melting rate is needed due to the thinner sections of the mould encountered in thin slab casting. The form of the free carbon is also important as this controls the melting rate and amorphous carbon black is preferred to better achieve an even distribution of carbon on the surface of the flux granules to ensure consistency in the melting rate of the flux.

The mould fluxes are fed into the free meniscus of liquid steel contained in the oscillating mould. Here it de-carburises and melts through uni-directional heating and forms several layers of a completely molten pool of slag beneath newly added un-melted flux. The liquid slag infiltrates into the mould strand channel where it lubricates the interface between the water cooled copper mould and the solidifying shell of steel passing down the mould. An optimum depth of the liquid slag pool is required for constant supply and infiltration of the liquid slag into the mould.

Sample	1	2	3	4	5
C <sub>total</sub>	10.17	6.02	6.26	6.06	6.67
SiO <sub>2</sub>	20.83	22.77	28.61	29.49	28.83
Fe <sub>2</sub> O <sub>3</sub>	0.97	1.51	1.09	1.54	3.60
Al <sub>2</sub> O <sub>3</sub>	4.31	3.64	3.23	4.86	6.14
CaO	32.97	29.18	33.30	37.49	30.92
MgO	0.98	3.22	3.60	0.35	10.84
Na <sub>2</sub> O	25.32	30.34	12.52	17.19	9.26
K <sub>2</sub> O	0.12	0.14	0.05	0.10	0.41
F	1.73	2.70	11.14	2.04	3.24

Table 1 Chemical compositions (wt%) of the mould flux investigated

Average	Softening temp °C	Melting temp °C	Flow temp °C
Thin Slab Casting Flux	995	1048	1112
Conventional CC Flux	1091	1145	1187

Table 2 Average softening, melting and flow temperature of fluxes for thin slab and conventional slab casters

Sample No	Viscosity (Pa.s) at temperature (°C)				Remarks
	1200	1250	1300	1360	
1	-	0.129	0.0965	-	Thin Slab Casting Flux
2	0.141	0.116	0.089	-	
3	0.210	0.141	0.092	-	
4	0.215	0.144	0.084	-	Conventional CC Flux
5	-	0.139	0.096	0.067	

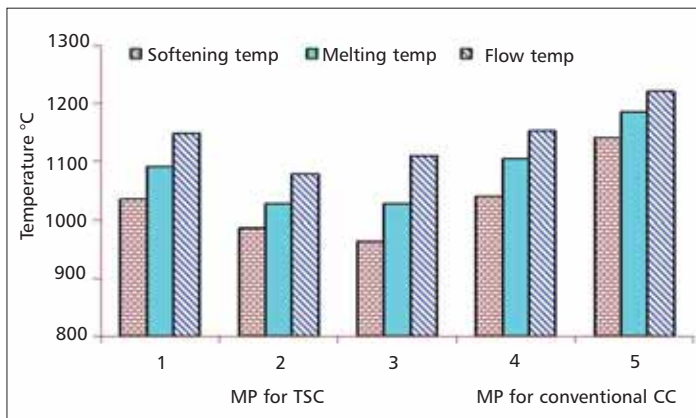


Table 3 Viscosity of molten fluxes at different temperatures

Fig 1 Melting trajectory (softening, melting and flow temperature) of various fluxes

In general, a mould flux used for thin slab casting is derived from the type used for conventional slab casting. Several authors<sup>(1-6)</sup> have reviewed the design of conventional CC mould powders. Only a few articles<sup>(7-9)</sup> address the selection of a mould powder for thin slab casting. To select a mould flux for high speed thin slab casting, an assessment of the critical physical properties, namely; viscosity of the molten flux (slag), the melting rate of the flux powder and the form of the free carbon, is necessary. In this report, these properties have been investigated and characterised as compared to fluxes used for conventional CC.

## Laboratory experimentation

Three samples of thin slab caster fluxes were obtained from different manufactures, two (# 1 & 2) from supplier A and one (# 3) from supplier B. Two samples of conventional CC fluxes (# 4 & 5) currently used at Bokaro Steel Plant

were selected for comparison. The chemical compositions of different samples are shown in Table 1.

## Melting trajectory

All the five samples were decarburised by heating to 800°C for 3 hours in a resistance furnace. Each powder sample was then evaluated in a hot stage microscope to determine the melting trajectory ie softening temperature, melting temperature and flow temperature. To do this, the powders were compressed into a cube 3mm in size and a heating rate <10°C per minute was applied in the microscope. The results are shown in Fig 1 for each sample and as the averages for thin slab vs conventional slab flux in Table 2.

## Viscosity

Decarburised samples were used to measure the viscosity of the molten fluxes at various

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temperatures using a rotating 'bob type' viscometer. In this test, viscosity is calculated by measuring the torque of a rotating cylinder immersed in the slag contained in a cylindrical container. Standard test fluids were used to calibrate the instrument. The results are presented in **Table 3**.

**Melting & Cooling parameters**

Differential Scanning Calorimetry (DSC) was used to find the melting and cooling properties of each flux. The samples were heated to 1300°C using a moderate heating rate of 10°C/min thereafter a slow cooling rate of 2°C/min was applied. Typical heating and cooling curves were plotted and the outcomes of these are tabulated in **Table 4**.

**Rate of melting**

A laboratory set-up was prepared to measure the melting rate of each sample using the molten slag drip test method<sup>(10)</sup>. In this test, 200g of sample was placed in a recess on the top of a graphite block bored with a vertical passage 9.5mm diameter. This was surrounded by an induction heating coil. On melting, the slag dripped through the bore hole and was collected and continuously weighed as shown in **Fig 2a & b**. The carbon block was maintained at a temperature of 1500+5°C throughout the experiment, this being monitored by a thermocouple (Pt-Pt10%Rh) inserted into the heated block. The melting rates (g/cm<sup>2</sup>/min) of the various mould powders were measured and tabulated as recorded in **Table 5**. The area referred to in the table is the surface area of the top of the graphite block ( $A = 3.14 * 5.08 * 5.08 = 81\text{cm}^2$ ) (See **Fig 2a**).

**XRD analysis**

The form of the free carbon plays a vital role in the control of the melting rate. Therefore, the type of carbon in terms of the degree of crystallisation was qualitatively determined by X-ray diffraction. The results which distinguish between the amount of amorphous carbon present – by measuring the broadening of the carbon peaks – and the amount of crystalline carbon are given in **Table 6**.

**Results and discussion**

**Flux Viscosity**

To minimise the frictional forces between mould and steel shell of the withdrawing slab the selection of a flux with low viscosity is important. The measured viscosity values at different temperatures (**Table 3**) shows that the viscosity at 1300°C for all five samples are near similar and lie in a range of 0.084 - 0.0965 Pa.s for both thin slab and conventional caster fluxes. But at the lower temperatures of 1250°C and 1200°C, the viscosity for thin slab casting fluxes are more than 10% less than for the conventional CC fluxes. It is the convention to measure viscosity at 1300°C. For thin slab casters, lubrication in the wide face of the mould is more important where the liquid slag temperatures are expected to be substantially lower than the temperature of the strand near the point of entry of the metal into the mould (the SEN). Therefore, the viscosity of fluxes for thin slab caster should also be measured at a lower temperatures of 1200°C and 1250°C during selection of a flux.

**Melting characteristics**

The melting behaviour of a flux is a very impor-

Sample No	Melting curve			Crystallisation temp	Glass - transition temp
	Melting start	Melting temp	Melting finish		
1	960	1072	1200	-	926
2	881	1070	1120	-	824
3	877	1145	1205	-	863
4	1086	1178	1226	897	-
5	1002	1214	1228	-	-

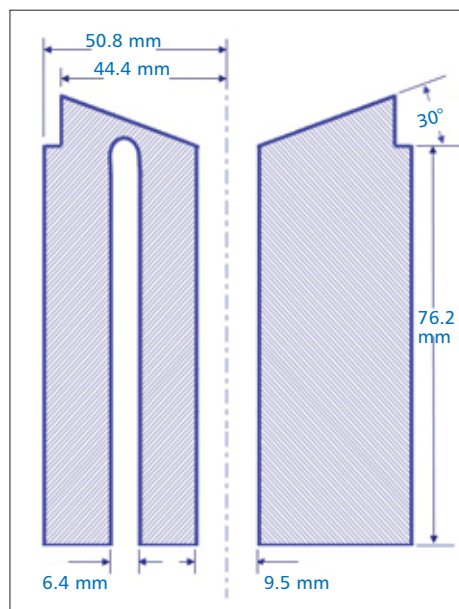
**Table 4 DSC analysis of mould fluxes**

Sample No	Drained slag (gm)	Time (min)	Heating surface (cm <sup>2</sup> )	Melting rate (gm/cm <sup>2</sup> /min)
1	58	7	81	0.1023
2	56	7	81	0.09876
3	63	7	81	0.1111
4	28	7	81	0.0494
5	23	7	81	0.0406

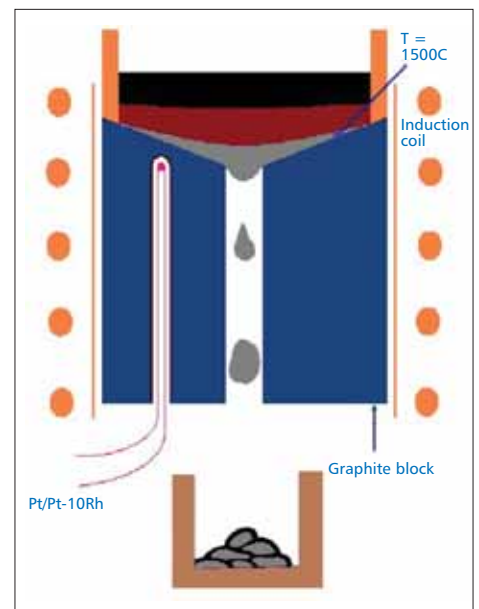
**Table 5 Melting rate measurement with slag dripping**

**Table 6 Study for free carbon of mould fluxes by XRD**

Sample No	Crystalline carbon (%)
1	1.7
2	nil
3	5.5
4	9.8
5	12.9



**Fig 2a Dimensions of the equipment for melt rate measurement under slag drainage condition**



**Fig 2b Schematic for melting rate determination at slag draining condition**

tant parameter for smooth functioning of the continuous casting machine. These parameters include the melting rate and melting trajectory (softening, melting and flow temperature) of the flux. It is necessary that the powder should melt at a rate that is compatible with the rate of powder consumption.

**Melting trajectory**

The melting trajectory of the fluxes evaluated using the hot stage microscope show the average softening temperature and melting temperature are lower by ~100°C and average softening temperature is lower by ~75°C for the thin slab caster fluxes compared to conventional CC (**Fig 1**, and **Table 2**). The lower melting temperature of the thin slab caster flux is indispensable in achieving the lower viscosity of the liquid slag needed to combat the lower temperatures experienced on the wide face of the lower part of the mould. The high aspect ratio of the thin slab caster mould typically 16:1 as compared to 10:1 for conventional CC, means the expected strand temperature, particularly at the wide face, will be lower for thin slab casters due

to their higher rate of cooling. Lubrication failure in the lower part of the mould if the liquid slag solidifies causes sticker breakout and must be avoided. Choosing a flux with a low melting temperature should help to control this. This indicates that a flux must have a lower melting temperature so that it can acquire lower viscosity at lower temperatures compared with a flux for a conventional caster as well as to avoid solidification at the wider face in the lower part of the thin slab caster mould.

**Melting and cooling characteristics**

The results for Differential Scanning Calorimetry show that the start of melting begins at a lower temperature for the thin slab fluxes. The melting temperature is also lower for thin slab caster fluxes compared to conventional CC fluxes which shows a good agreement with the measured melting trajectory (**Table 4**).

No crystallization temperature was found for any of the thin slab fluxes. The glass transition temperature for the thin slab caster fluxes tested were 926, 824 and 863°C. A crystallization temperature was found only in the convention-

al caster flux intended for use when casting low C peritectic grade steels. The effect of crystallisation is especially important for fluxes which are used for casting crack sensitive steel grades.

### Melting rate

The melting rate of the flux under draining condition averaged  $0.104\text{gm/cm}^2/\text{min}$  for fluxes for thin slab casters to  $0.045\text{gm/cm}^2/\text{min}$  for conventional casters (Table 5). The melting rate for thin slab casting fluxes is thus more than double that of fluxes for conventional casters. But some literature<sup>(5,6)</sup> reports similar melting rates for the fluxes for both types of casters reporting ranges in terms of  $\text{kg/min}$  of  $0.4 - 0.8\text{kg/min}$ . This conflict can easily be understood by consideration of the physical dimensions used to express the melting rate which, in the experiments performed in the present analysis take into account the area of the mould metal meniscus as well as consumption per unit time rather than simply the consumption per unit time as in the literature. The area becomes increasingly important when differentiating between the two types of mould fluxes. Comparing the surface area of the liquid steel meniscus inside the mould, this will always be less in the case of the thin slab caster mould due to its smaller thickness while keeping the width similar to that of a conventional slab mould. As the surface area decreases a mould flux requires a higher melting rate per unit area per unit time ( $\text{kg/cm}^2/\text{min}$ ) but this appears as a similar melting rate in terms of weight per unit time ( $\text{kg/min}$ ). Thus the melting rate and powder consumption should be compatible in values. In other words, the rate of powder consumption is a reasonable measure of the rate of molten slag flow into the mould – strand gap and therefore the required melting rate of the flux. Powder consumption can be reported in term of the solidified steel surface area  $Q_s$  ( $\text{kg/m}^2$ ), or in terms of the amount of flux used per tonne of steel cast  $Q_t$  ( $\text{kg/t}$ ), or it can be reported<sup>(11)</sup> as the powder consumption per unit time  $Q_o$  ( $\text{kg/min}$ ). Powder consumption per unit area  $Q_s$  decreases with increasing casting speed. The literature<sup>(11)</sup> reports that a powder consumption  $Q_s$  of  $0.1\text{kg/m}^2$  for a casting speed of  $\sim 8\text{m/min}$  is sufficient for smooth operation, however powder consumption is much less than this for a slow casting speed of  $\sim 2\text{m/min}$  typical of a conventional thick slab caster, which requires only  $0.4\text{kg/m}^2$ .

It has also been reported that gravity is the main driving force for inflow of liquid slag between the mould – strand channel and thus powder consumption ( $Q_o$ ) remains constant. The powder consumption per unit time  $Q_o$  is

independent of the casting speed, but its value is dependent on the steel grade, mould oscillation conditions, and the properties of the powder. With consideration, it can be noted that the melting rate in terms of  $\text{kg/min}$  for both casters needs to be similar. As the thickness of a thin slab mould and thus the surface area of the liquid steel meniscus is less than half that of a conventional mould the thin slab caster requires a mould flux with more than twice the melting rate in terms of area ( $\text{kg/cm}^2/\text{min}$ ) of that for a conventional caster. Thus the laboratory result shows good agreement with the literature. Therefore, discrimination between fluxes for thin slab and conventional slab casters can be achieved by measuring the melting rate expressed in terms of surface area of the meniscus.

### Form of free carbon

The melting rate is mainly controlled by the addition of a suitable form of carbon because this serves as an inert barrier between the solid particles of flux and liquid droplets<sup>(4)</sup> of slag formed on melting the flux. The melting rate increases as the carbon content decreases. A fine form of carbon such as carbon black is more effective than a coarser one such as ground coke due to difference in particle sizes. The finer carbon black is more effective in coating the flux granules than coarse particles such as ground coke.

Two of the thin slab caster fluxes contained small amounts of crystalline carbon and one no crystalline form. The majority of carbon was amorphous ie carbon black. The conventional CC fluxes contains higher percentages of crystallised carbon indicates the presence of coke dust and graphite as constituents of the free carbon.

The importance of the effectiveness of the carbon in controlling the rate of melting is also evident in controlling the depth of the liquid slag pool produced by the flux.

### Liquid slag pool

In thin slab casting, the feeding of liquid steel into the mould is more difficult than conventional casting due to the narrowness of the mould and the need to maintain a higher casting speed. This affects the surface turbulence of the metal meniscus because of the reduced inner volume of the mould. Therefore, problems associated with meniscus stability, free surface fluctuations, and mould flux entrapment may be more severe. Kromhout et al<sup>(8)</sup> has recommended that the depth of the liquid pool of flux slag should be limited but not be less than 5mm to ensure smooth functioning during thin slab casting. This is much less than the slag

pool thickness of 20 – 30mm for conventional continuous casting. To keep a consistent minimum thickness of liquid slag pool, it is important to select a melt rate inhibitor which can provide uniform coating of the flux particles. One grade of fine carbon black should be used as free carbon for the flux of thin slab casting. Uniformity in coating of the granules provides the consistency in melting rate and stability in liquid slag pool thickness.

### Conclusions

In comparison with a flux for conventional casting, a flux for a thin slab caster requires a higher melting rate expressed in terms of  $\text{gm/cm}^2/\text{min}$ , so taking into account the reduced surface area of the slag pool compared to a conventional mould. This can be achieved by selecting a flux with a lower melting temperature. The lower melting point also helps to maintain a low viscosity of the liquid slag as it is drawn further down the mould where lower temperatures are experienced. Fine carbon black should be used as the free carbon additive to better control the melting rate by ensuring complete coating the individual granules of flux. The greater consistency in melting rate so afforded helps produce a stable slag pool thickness. ■

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## This Working Life: Steel – A century of steelmaking on film

IN February 2013, the British Film Institute (BFI) launches a twin box set DVD containing a collection of 21 films featuring UK's steel industry.

Some of these are documentary, others animations some fictional stories taking place in steelworks and others showing the use of steel. They span the period 1901 to 1985.

Featured on the DVD is a rare colour record made in 1945 called 'Steel' which was filmed by Oscar-winning Jack Cardiff. Other gems are 'Men of Consett' (1959), 'Woman of Steel' (1984) – about steelmaking in wartime Sheffield, 'Parkgate Iron & Steel Co' (1901), 'Song of the Builder' (1936); and the anima-

tion, 'River of Steel' (1951).

The DVD set is the third in a series recording the past industries of Britain following the release of 'King Coal' in 2009 and 'Tales from the Shipyard' in 2011.

The price of the DVD box set is £24.99 and the release date 18 February 2013. Available from BFI bookshop [www.bfi.org.uk/shop](http://www.bfi.org.uk/shop)

### Also showing

For those who are fortunate enough to be close enough to visit one of the BFI 'Mediatheques' which provide free access to the BFI film archive (some 500 plus films) there are already several steel films available. The BFI will even-

tually add further films on steel from the DVD collection.

Mediatheques are located at BFI South Bank, London; Discovery Museum, Newcastle; the QUAD, Derby and Wrexham Library.



'Men of Corby' tapping a blast furnace

# The recovery of ferro-alloy fines by melting in an induction furnace

A method of recovering ferro-alloy fines generated when crushing lump alloy and sizing for steelmaking has been developed by melting in an induction furnace containing a starting pool of molten steel into which the fines are added.

By\* K K Keshari, Somnath Kumar, Snehangshu Roy & Y K Khanna

FERRO-ALLOYS are an integral ingredient of the steelmaking process and are added to develop certain property in the finished product. Ferro-alloys are normally added through a hopper fitted with a vibro-feeder and conveyer system. The size requirement of ferro-alloy varies from plant to plant depending on the opening of vibro-feeder and system design. In order to meet stringent size requirement of customers, the ferro-alloy producer converts larger size lumps to specific sizes either manually or using mechanical crushers. During the process of sizing, a large quantity of fines (below 12mm) is generated which is difficult to use in the steelmaking vessel or the ladle in secondary refining units due to their low recovery of alloy and the tendency to choke the suction duct.

Melting of these ferro-alloy fines by charging directly to an induction furnace proved impossible as the small particle size prevents the magnetic coupling necessary to induce sufficient current to heat the charge and melt it. But fines can be melted in an induction furnace pre-charged with a pool of molten metal by first melting larger charge items such as steel scrap. This referred to in this article as the 'indirect technique'.

The present work was carried out in a 100kg air induction furnace at the corporate R&D centre of SAIL, and deals with the technique adopted to convert ferro-alloy fines into larger lumps with minimal effect on the end quality of the resulting alloys. The converted ferro-alloy has been readily crushed to the sizes required for steelmaking.

## Production of ferro-alloys

Chandrapur Ferro-alloy Plant (CFP), Chandrapur is a unit of the Steel Authority of India Ltd (SAIL) which produces ferro-alloys. It is the largest producer of Manganese ferro-alloys in India with an installed capacity of 100kt/y of Ferro Manganese. The product range at MEL includes High Carbon Ferro Manganese, Silico Manganese and Medium/Low Carbon Ferro Manganese. The plant is presently undergoing a modernisation and expansion programme to meet future demands of SAIL's plants. Over the years, CFP has emerged as a leader in ferro-alloy production with technological developments but the plant was facing a chronic problem related to the generation of fines (<12 mm) during crushing and sizing of the ferro-alloys required to meet the customer's desired size for steelmaking. With the installation of a new automatic sizing machine, the generation of fines had further increased by 10-15% and reduced yield through fines has become the major concern.

The large quantity of fines generated during crushing and sizing adversely affected the techno-economic parameters of the plant resulting in a high cost of production.



Fig 1 Cast ingots of HCFeMn fines cast from a 28kg steel scrap starting pool with 21kg HCFeMn added at 3kg every 3 minutes



Fig 2 Broken SiMn lumps cast from 15kg steel scrap starting pool with 30kg SiMn fines added at 3.0kg every 5 minutes



Fig 3 Broken pieces of HCFeMn cast from 12kg steel scrap starting pool with 30kg FeMn fines added at 3.0kg every 5 minutes



Fig 4 Pieces of cast ingot broken during stripping when 33kg of SiMn fines were added to a 11kg scrap steel starting pool

Sample No	Total Wt (kg)	<3.0mm kg (%)	3.0-5.0mm kg (%)	5.0-10.0mm kg (%)	10.0-12.0mm kg (%)
Bag-1	50.750	27.1 (53.31)	6.15 (12.14)	16.2 (31.98)	1.30 (2.57)
Bag-2	48.850	23.7 (48.52)	5.70 (11.67)	14.3 (29.27)	5.15 (10.54)

Table 1 Size distribution of fines

Product	Chemical composition (%)				
	Carbon	Manganese	Phosphorous	Sulphur	Silicon
HCFeMn	6.10	66.46	0.30	0.011	1.66
SiMn	1.97	57.23	0.29	0.014	16.67

Table 2 Analysis of Ferro-alloy fines

## Characterisation of ferro-alloy fines

The results of characterisation studies carried out on the fines follow:

Screen analysis: The ferro-alloy fines received from CFP Chandrapur were screened and the size fractions resulting are given in **Table 1**.

The chemical composition of high carbon HCFeMn and SiMn fines is given in **Table 2**.

## Melting in induction furnace

A melting process using an induction furnace had been developed at Hydro-Quebec's research Institute<sup>[1]</sup> to address the problem of recovering ferro-alloy fines. The feasibility of melting such fines in an induction furnace was demonstrated by Hydro on a small scale. A pilot trial was carried out using a 100kW low frequency (~ 3000 Hz) furnace of liquid metal

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	Scrap (kg)	Fines (kg)		Cast Wt (kg)	Final analysis (%)					Recovery (%)		Fines/metal ratio	Fines (%)
		HC FeMn	SiMn		C	Mn	P	S	Si	Mn	Si		
1	0	15	0	0								NA	100
2	28	21	0	45	3.6	29.68	0.016	0.072	0.27	93.49	-	0.75	43
3	15	0	30	36		39.4	0.236		11.8	82.06	82.99	2.00	67
4	12	30	0	35.8	5.4	49.23		0.004	0.20	87.28	-	2.50	71
5	11	0	33	38.6		44.80	0.262		12.1	91.16	82.86	3.00	75
6	9	63.7	0	57.6	6.02	60.12	0.279		0.09	81.01	-	7.08	88
7	8	0	54	49.6	2.45	52.90	0.262		13.2	84.73	70.90	6.75	87

Table 3 Summary of ferro-alloy fines melting in an air induction furnace

capacity 140kg. The operating parameters were determined during the pilot process. The study concluded that for successfully melting of fines, the larger size fraction must be added in the initial charge during furnace startup. For successive charges, a liquid metal melt corresponding to 25-35% of the furnace capacity must be maintained in the furnace.

At SAIL R&D, two approaches were tried to melt the fines and cast into ingot for crushing:

**Direct charging of Ferro Alloy Fines:** Ferro alloy fines of HCFeMn and SiMn were separately attempted to be melted by charging directly into a 100kg air induction furnace. The ferro alloy particles failed to melt even after several hours of furnace operation.

**Melting of Fines in a Metal Pool:** Ferro alloys fines could be melted in the induction furnace provided a pool of molten metal was first established by melting larger lumps of mild steel scrap.

Two approaches were successfully tried, the first establishing a pool of molten metal by melting sufficiently large pieces of mild steel scrap to which the ferro-alloy fines were then added.

The second approach was to charge together sufficiently larger pieces of mild steel scrap along with the ferro-alloy fines, and then create the induced current in the scrap to melt this and absorb the ferro-alloy fines into the liquid metal pool. The first two trials used fines larger than 3.0mm but from the third heat onwards fines smaller than 3.0mm were also charged and melted without difficulty.

Ferro-alloy fines below 12mm in size were successfully melted with varying proportions of fines and steel pool mass. Ratios of alloy fines to scrap pool ranging from 43% to 88% were successfully melted and cast into ingots. The trials consisted of:

**Experiment 1:** 100% fines of HCFeMn and SiMn were charged to an air induction furnace but failed to melt even after several hours in the furnace.

**Experiment 2:** 28kg of scrap steel were first melted in the induction furnace and addition of HCFeMn fines were charged to this pool in batches at an approximate rate of 3kg every 3 minutes. A maximum of 21kg was added. The resulting cast ingot was very hard and could be broken only after long hammering (Fig 1).

**Experiment 3:** After the successful agglomeration of HCFeMn, emphasis was given on reducing the amount of scrap in the starting pool and maximising the amount of ferro-alloy fines added to the charge. In experiment 3, 15kg of steel scrap was first melted in the induction furnace followed by addition of SiMn fines at the rate of around 3.0kg every 5 minutes. A total of 30kg SiMn fines were charged this way into the melt. The rate of dissolution of the SiMn fines was much greater compared to the HCFeMn of experiment 2. After casting into ingot, the cast product broke into small pieces while stripping (Fig 2).

**Experiment 4:** In this experiment, the quantity of steel scrap was further reduced to 12kg and FeMn fines were added at the rate of 3.0kg every 5 minutes. A total of 30kg FeMn fines were added before terminating the experiment taking into regard the increasing rate of attack on the furnace refractories as the concentration of Mn increased. The melt was tapped into ingots which were found to be more easily broken compared to those from experiment 2 (Fig 3).

**Experiment 5:** The amount of steel scrap was further reduced to 11kg and 33kg of SiMn fines added to the melt at the rate of 3.0kg every 5 minutes as before. The ingot broke into pieces during stripping as experienced in experiment 3 (Fig 4).

**Experiment 6:** To maximize the concentration of ferro alloy in the resulting ingot the weight of

the starting scrap was further reduced to 9kg placed in the bottom of the induction furnace and this was surrounded with 4.7kg of HCFeMn fines prior to melting the steel scrap. Once a pool of metal was established a further 59kg of FeMn fines were added to the melt at a rate of 3.0kg every 5 minutes. The ingot produced in this case was easier to break. Some small erosion of furnace bottom was observed after tapping due to the high concentration of Mn in the melt.

**Experiment 7:** A similar procedure, as in experiment 6 was adopted to melt SiMn fines. 8kg of mild steel scrap and a total of 54kg of ferro silicon fines were melted. The cast ingot was easily broken into smaller sizes. The details of each experiment and the results are summarised in Table 3.

The recoveries of Mn & Si during melting in the air induction furnace were found to be 82-94% for Mn and 70-83% for Si. It should be possible to improve these figures by the adoption of a suitable refining practice in an industrial scale.

### Conclusion

Melting of ferro-alloy fines in an air induction furnace is possible provided a starting pool of molten metal is first created from steel scrap. The greater the proportion of fines added by minimising the mass of the starting pool the higher is the alloy yield so producing a high alloy concentration suitable for use in steel-making.

The addition of an electro-magnetic stirrer (EMS) in the furnace would further improve the dissolution rate on an industrial scale. ■

### Reference

[1] C Lemire & A Biscaro 'Induction Melting of Ferro-alloy Fines', 10th International Ferro-alloys Congress, 1- 4 February 2004, pp 528-532

## PANalytical becomes distributor of OBLF OES

PANalytical and OBLF jointly announce that a formal agreement has been signed for the exclusive distribution of OBLF's optical emission spectrometers by PANalytical in Finland, Sweden, Norway, Denmark, the Netherlands, Belgium, Luxemburg, United Kingdom, Ireland, France, Spain, Portugal, Italy, South Africa, USA, Canada and Brazil.

PANalytical X-ray fluorescence (XRF) spectrometers and OBLF optical emission spectrometers (OES) perform complementary roles in the analysis of solid metals. When deployed together, XRF and OES enable the determination of dozens of elements over concentration

ranges from sub-ppm to 100% within seconds.

This combination of speed and versatility makes XRF and OES ideal for laboratories where metals analysis is a primary task. In addition to numerous automated laboratory installations featuring both XRF and OES 'stand-alone' instruments, the co-operation between the companies has already resulted in the development of TEAMworks, a fully automated laboratory system combining OES, XRF and robotic sample handling. For these combined systems, PANalytical has taken full responsibility for installation, training, maintenance, and application support for both its own X-ray spec-

trometers and OBLF's optical emission spectrometers.

Both companies share a philosophy of quality first, and both operate a quality management system in accordance with ISO 90012008.

### About PANalytical

Founded in 1948 as part of Philips, and now part of Spectris plc, PANalytical is one of the world's leading supplier of analytical instrumentation and software for X-ray diffraction (XRD) and X-ray fluorescence spectrometry (XRF).

www.panalytical.com/oes

# Alacero 2012: Waiting for a better future

The impact of the declining state of the global steel industry was the focus of the 2012 Latin American Steel Association conference, China, as in all recent years, having the greatest impact. An average 4% growth in per capita consumption in Latin America will lead to the steel trade deficit increasing from 900kt in 2011 to 2.7Mt in 2012 as the region increases crude steel output by just 2.8% to 55.5Mt. **By Germano Mendes de Paula\***

THE 53rd conference of Alacero, (Asociación Latinoamericana del Acero – ie the Latin American Steel Association – formerly ILAFA) was held in Santiago, Chile on 28-30 October 2012. Approximately 800 delegates attended the event, 20% fewer than at the previous annual meeting held in Rio de Janeiro in 2011. This can be interpreted as a sign of the difficult times that the Latin American steel industry is now facing. Indeed, although the presentations were quite diverse, regarding the steel business per se, the general conclusion was that it would take some time to overcome excess capacity globally and its implications of low pricing power and profits.

Alacero's Conference is habitually focused on two main issues: the global economy and the world steel market. Not surprisingly, this traditional and successful formula was maintained. However, this year, the presentations about the regional steel markets were even more interesting than usual.

## US market

Thomas J Gibson – President and CEO of American Iron and Steel Institute (AISI) – addressed the outlook for the US economy and the US steel market. Initially, he paid attention to the macroeconomics. The country's GDP underwent a 3.1% contraction in 2009, but has been recovering since, expanding 2.4% in 2010 and 1.8% in 2011. A further improvement of 2.1% is expected in 2012 and 2.0% anticipated for 2013. Concerning industrial production, the respective figures are: -11.4% (in 2009), 5.4%, 4.1%, 3.9% and 2.5% (in 2013).

Despite the fact that industrial production performance has been generally positive, Mr Gibson stressed that the manufacturing deficit has increased. As can be seen in **Fig 1**, this deficit amounted to \$457bn in 2009 and is expected to reach \$670bn in 2012. Moreover, the share of the deficit arising from imports from China in the total manufacturing deficit increased from 45% in 2009 to 50% in 2012.

Unemployment in the USA remains persist-

Finished steel	2011	2012	Change (%)	2013	Change (%)
Industry Shipments	83.3	88.5	+6	92.1	+4
Finished Imports	19.8	22.7	+15	22.9	+1
Adjustments	1.8	2.0	–	2.2	–
Exports	12.2	12.8	+5	12.9	0
Apparent Steel use (ASU)	89.1	96.5	+8	100.0	+4
Inventory Change	0.6	1.1	–	0.9	–
Real Steel Use (RSU)	88.5	95.4	+8	99.1	+4

Source: AISI

**Table 1 US finished steel demand, 2011-2013 (Mt) (metric tonnes)**

ently high. For instance, it is forecast to stay around 8% in 2013, which is considerably higher than the plateau reached in the pre-crisis period (4.6% in 2007). In addition, the consumer confidence index remains far below a healthy level.

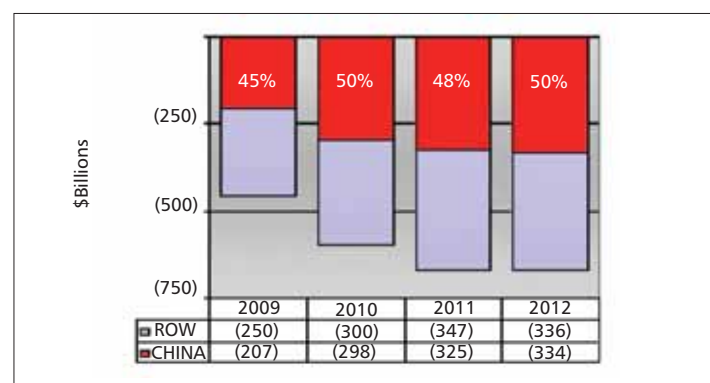
Looking at the steel consumer markets, AISI's President showed that production of light vehicles rose 25% in 2012H1. Nevertheless, for the construction industry, public sector expenditure remains weak. After a good first half 2012, the US steel market is experiencing a retreat in the second semester. There is a clear decline in terms of utilisation of installed capacity. Bearing this condition in mind, according to the AISI, apparent steel consumption will increase 8% in 2012 and a further 4% in 2013 (**Table 1**). It is worth mentioning that the recovery is expected to continue but, even if these predictions are achieved, apparent steel demand in 2013 would still be only 85% of that of the four-year annual average prior to the 2008-2009 recession. Steel shipment were on target to grow 6% in 2012 and the forecast growth for 2013 is 4%. Imports of rolled products would increase 15% and 1% in 2012 and 2013 respectively. Exports would grow 5% in 2012 but be zero in 2013.

Mr Gibson's concluding comments were on the so-called 'fiscal cliff'. There will be expiring tax provisions (totalled \$381bn) and mandatory spending cuts (\$136bn) during fiscal year

(FY) 2013. According to Congressional Budget Office (CBO) projections, if the fiscal cliff is avoided or delayed for a year: a) the budget deficit will be \$1trillion in FY 2013; b) the unemployment rate would remain at 8%; and c) the real GDP would grow by 1.7%. Nonetheless, if there is no solution and the fiscal cliff is triggered: a) the budget deficit in FY 2013 will shrink to \$641bn; b) the unemployment rate will increase to 9.1% in 2013H2; and c) real GDP will decline by 0.5% between 2012Q4 and 2013Q4. As a consequence, the US steel market would experience quite different paths next year, pending the outcome of the fiscal cliff problem.

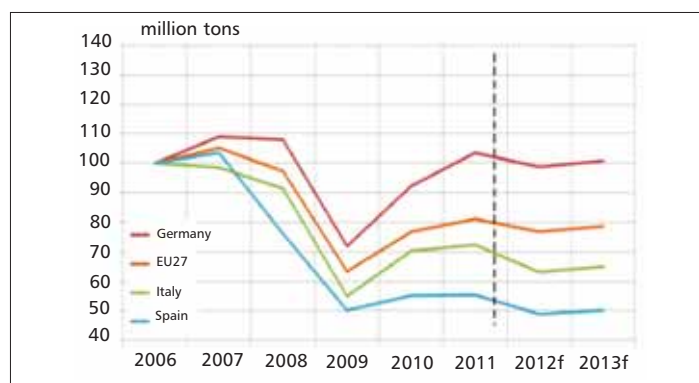
## European market

Mr Hans Jürgen Kerkhoff – President of Wirtschaftsvereinigung Stahl (WVS – the German Steel Federation) – analysed the macroeconomics and steel market in Europe. He highlighted that the European Union GDP grew by 1.4% in 2011, but growth would fall by -0.4% in 2012 followed by a weak recovery of 0.2% in 2013. However, the performance between the European nations has varied significantly. For instance, Greece is expected to see GDP shrink by -6% in 2012 and a further -4.0% decrease in 2013, whereas German GDP will expand 0.9% in both years. Major industrial countries, such as Spain and Italy, will be in the 'red zone' in 2012-2013. Regarding the



**Fig 1 US manufacturing trade deficit, 2009-2012 (\$bn)**

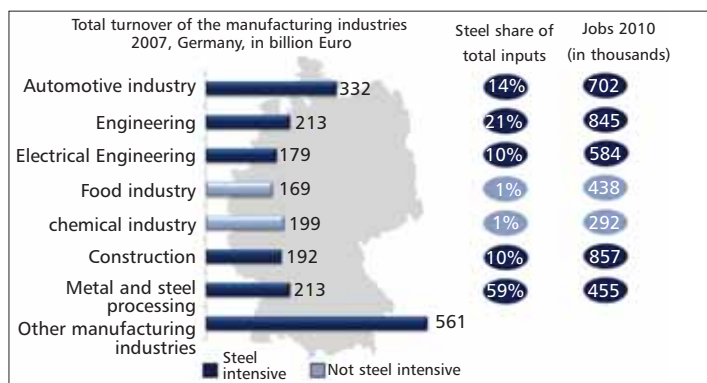
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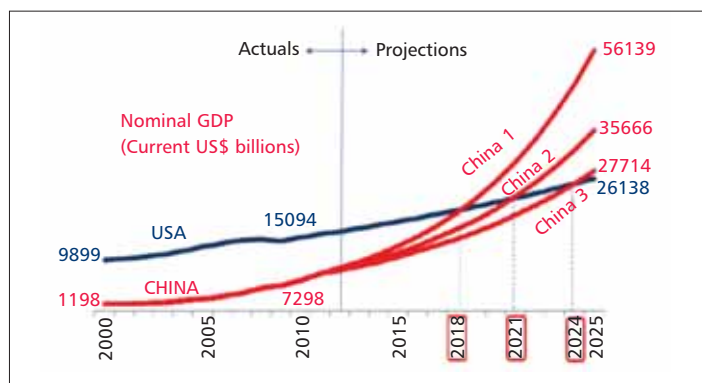
**Fig 2 Apparent steel consumption in selected EU countries, 2006-2013 (2006 = 100)**

Source: H J Kerkhoff WVS

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**Fig 3 Turnover of the German manufacturing industries, 2007 (Euro bn)** Source: H J Kerkhoff WVS



**Fig 4 US and China's GDP projections, 2000-2025 (\$bn)** Source: Ms H Wang China India Institute

growth in industrial output, Germany has also a more favourable situation comparatively to its regional peers.

Germany is the largest European steel producer. In 2011, it made 44.3Mt of crude steel, which was equivalent to 25% of European output. It was followed by Italy (16%), France and Spain (9% each), and the UK (5%). On the demand side, the most important steel consuming markets in Europe in 2011 were: construction (28%), automotive (16%), mechanical engineering (14%), structural steelworks (12%), tubes and metalware (11% each), and miscellaneous (8%).

**Fig 2** demonstrates the change in apparent steel consumption in the European Union, Germany, Italy and Spain, during 2006 to 2013. Considering 2006 as the base year, demand in the EU declined some 35% in 2009 and, despite a partial recovery after this, it is expected that demand in 2013 will be 20% lower than it was in 2006. In Spain, the situation is more dramatic, as the country's consumption in 2013 will be approximately half of that in 2006. In contrast, demand in Germany has already returned to a similar level to that in 2006.

The explanation for the better steel demand in Germany is related to the strength of its industrial sector. The share of industrial activities in German GDP, grew marginally from 25% in 1995 to 26% in 2008.

In UK, this ratio plummeted from 26% in 1995 to 16% in 2008, while the respective figures for France were 19% and 14% and for Italy a drop from 25% to 21%. Thus, Germany has been able to avoid the so-called process of 'de-industrialisation'.

**Fig 3** shows that the majority of manufacturing industries in Germany are steel intensive users. For example, the automotive industry's turnover was €332bn in 2007 and generated 702k jobs in 2010. The share of steel production in the value of the automobile industry to the German economy was equivalent to 14%. For construction, the respective numbers were €192bn, employing 857k and steel's share of input was 10%.

Considering all the major steel intensive manufacturing industries, together they generated 3.4M direct jobs, which is an impressive evidence of a robust metal-mechanical industry in Germany.

Considering the value chain, Mr Kerkhoff highlighted that the regional proximity of the steel industry is an important factor for German industry. The high customer demands regarding quality, costs and delivery service can only be met through short delivery routes and close integration in the supply chain. There are short-

cycle deliveries and small quantities per delivery due to operating a 'just-in-time' logistics system. Short transportation routes minimise environmental impact and reducing the number of handling steps minimise the danger of damage during transit. Thus, due to high logistical efforts, steel in Europe is largely delivered on a regional basis, generally within a 800km radius around the steelworks.

In spite of the favourable situation in the German steel industry, there are many challenges to be faced, according to Mr Kerkhoff, such as: a) increasing volatility of international trade; b) Russian accession to the WTO; c) growing protectionism; d) ambitious energy policy targets in the European Union for 2020, with strong impact on emission regulations in particular for blast furnaces; and e) the growing market power of raw material suppliers and high prices for raw materials. Therefore, even for Germany, the least negatively impacted European steel industry, the situation is far from a 'blue sky'.

### Chinese market

Ms Haiyan Wang – Managing Partner of China India Institute – delivered a vibrant presentation on China. Nevertheless, because she is an expert on China, but not on steel in particular, she stressed macro and political features. Anyway, she showed a deep and updated view on very important features.

Ms Wang commented that China will surpass the USA in terms of nominal GDP, around the middle of the next decade. She showed three scenarios as to when this will happen: a) an optimistic one when it will occur as early as 2015; b) a base one, passing the USA in 2021; and c) a pessimist one which will delay the lead until 2024 (**Fig 4**). This will happen even though, in terms of per capita income, China is still a poor country. In 2011, its income per inhabitant reached only \$5430, in comparison with \$48442 in the USA.

Despite the recent deceleration, the Chinese macroeconomic environment continues to show good performance. GDP is expected to grow fast (at least 7% per annum); inflation is quite low (4%) and urban unemployment is below 5%. Urbanisation is increasing at 1% a year and the country will generate more than 45 million urban jobs during the period 2011-2015.

Concerning demographics, Ms Wang highlighted that the proportion of the population of working age will begin to decline from 2015 onwards. The amount and the corresponding proportion of the elderly population will skyrocket during the next four decades. Indeed, in

2010, China had 176M people aged 60 or older, which was equivalent to 23% of the total population. The respective figures for 2020 will be 243M and 18%; and, for 2050, 480M and 33%.

Ms Wang has also discussed the political landscape. She declared that the Chinese Communist Party (CPC) has 83M members. In addition, minority parties have not challenging the power of the CPC. She also paid attention to the 5th generation of leadership, which will run the country from November 2012 to 2022. There are many issues to be tackled for the new leaders in the political arena (greater democracy, accountability, transparency) as well as in the economy (reduction of dominance of State-Owned Enterprises, for instance).

Ms Wang also analysed the Chinese steel market, but took a general view. She told the audience that China's steel demand grew 11%-12% each year from 2006 to 2010 but slowed to a growth rate of 4%-5% each year from 2010-2015.

Ms Wang commented on the many steel producers in China, saying that the nation has more than 3000 steel mills. The low concentration of these – the top 10 producers accounting for 42% of the country's crude steel production – and low average capacity (less than 1Mt/y) have marked implications in terms of overcapacity, environmental pollution, energy waste, low bargaining power and low profitability.

She explained that there have been forced mergers and acquisitions, as a result of the goals established by central government, but with poor integration of the resulting merged enterprises. Therefore, the real benefits derived from consolidation have not been achieved (despite six Chinese steelmakers being ranked within the top 10 global crude steel producers in 2011).

Regarding the Chinese steel market per se, the most interesting presentation was delivered by Richard McLaughlin, Director Iron & Steel Consulting at Hatch Associates. He examined the global scrap market, but the main conclusions refer to China.

Mr McLaughlin believes global crude steel production will increase from 1.49bnt in 2011 to 1.87bnt in 2020 and even to 2.46bnt in 2030. He stated that the long-term rate of growth in steel production is certain to moderate from recent levels, with developing economies growing a 2.7% a year. Furthermore, a combination of factors – attractive and flexible size and capital and operating costs – will drive more rapid growth in electric arc steelmaking (EAF) compared to the integrated blast furnace – oxygen steelmaking (BF-BOF) route. Output of steel from EAFs will grow at a 5.1% annual rate in the developing world, he predicts.





**Fig 5 Pig iron and crude steel production in China, 2001-2025 (Mt)**  
Source: R McLaughlin Hatch Associates

Global EAF steel production will increase from 442Mt in 2011 to 600Mt in 2020 and 890Mt in 2030. Consequently, its share of total global production will grow from 29% in 2011, to 32% in 2020 and 36% in 2030.

Hatch's Director stressed that China will eventually emerge as the world's largest supplier of scrap. The critical question is how long will that take? To answer this question he highlighted that scrap rates (ie amount of scrap used in crude steel production) in China are the lowest amongst major steelmaking countries in both BOF and EAF steelmaking.

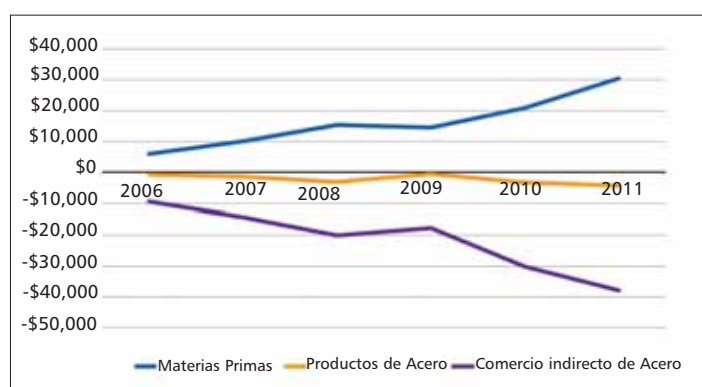
Regarding EAF, this rate is approximately 65%, whereas in the USA, Japan and Germany, it is over 90%. Concerning BOF, Chinese steel-makers use around 8% of scrap, against 21% in the USA, 17% in Germany and 14% in Japan. Considering this international experience, it can be concluded that there is room for significant increases in domestic scrap consumption in China.

Mr McLaughlin presented an estimate of the steel scrap balance in China. As can be observed in **Table 2**, there was a 5.0Mt scrap deficit in that country in 2010. Assuming that the scrap ratio in the EAF will grow from 70% to 85% and its use in the BOF will increase from 10% to 14%, in 2020, the theoretical scrap demand and supply in China will reach respectively 176Mt and 220Mt. Thus, a 44Mt surplus will be achieved. For 2025, maintaining the same assumptions, the scrap surplus will rise to 85Mt. The theoretical scrap supply is based on 70% of steel consumption at t-17 years.

According to Mr McLaughlin, there is a scrap reservoir building up in China of enormous proportions. This reservoir has been growing faster than the consumption of scrap, which could leave a significant excess of supply. While China's scrap processing industry has not yet matured, the scale of recent Chinese steel consumption suggests an accumulating reservoir that could be 'mined' within 5-10 years. He mentioned that participants in the Chinese scrap industry are growing in numbers and size, and the 12th 5-year development plan provides initiatives to accelerate that growth.

China currently serves a critical role in scrap trade by absorbing excess supply from other regions of the world. The currently scrap surpluses in North America, Europe and Japan balance the combined present deficits in China, Turkey, Middle East, and other Asian nations. Should China develop a significant presence in the scrap export market, the likely targets would be other Asian countries, Turkey and Middle East, and possibly South America.

Mr McLaughlin emphasised that the poten-



**Fig 6 Latin America-China bilateral trade of raw materials, direct and indirect steel products, 2006-2011 (\$M)**Source: R Gutiérrez, Alacero

**Table 2 Chinese steel scrap market, 2010-2025 (Mt)**

	2010	2020	2025
Steel production	630	800	850
of which EAF	63	80	100
of which BF/BOF	567	720	750
Assumed Scrap use	EAF @ 70%	EAF @ 85%	EAF @ 85%
	BOF @ 10%	BOF @ 15%	BOF @ 20%
Theoretical Scrap Demand	105	176	235
Theoretical Scrap Supply	100	220	320
<b>Balance</b>	<b>(-5)</b>	<b>44</b>	<b>85</b>

Source Hatch Associates

tial for scrap to displace high cost iron ore in China has not yet been realized, but it can be expected that this emerging and valuable resource will attract significant new investments over the medium-term.

Even if EAF steel production grows more rapidly (in China and elsewhere), the scrap volumes possible in China suggest increasing levels of exports (and volatility in prices). If economic conditions imply more modest growth in steel consumption and production on a global scale, the impact of Chinese scrap exports could be dramatic.

The alternative scenario – that China consumes all of its domestic scrap – has profound implications for future iron ore demand. **Fig 5** shows the evolution of pig iron and crude steel production in China to 2025. In the high-case scenario, crude steel production would peak in 2020 and then reduce marginally to a 1.0bn tonne plateau.

In the low-case scenario, maximum output would be achieved in 2015, at 800Mt. Nonetheless, in the high-case scenario, pig iron production will fall from around 790Mt in 2020 to 580Mt in 2025. In the low-case scenario, it will fall from 710Mt in 2015 to 370Mt in 2025.

China emerges as a significant exporter of steel, its impact on future scrap prices (and the economics of EAF steel production) could be substantial and must be considered. In Mr McLaughlin's words; "Timing is everything; but if history is any indication, the industry should expect China to build a vibrant scrap industry sooner rather than later".

**Latin American market**

Mr Raúl Gutiérrez, President of Alacero, was the final speaker of the Conference. As expected, he paid attention to the Latin American steel market. Regarding the external context, he said that uncertainties and turbulences have increased, due to: a) the sovereign debt crisis in the Euro Zone; b) slow economic recovery in the USA; c) China's slowdown; and d) global competition for jobs. In the particular experience of Latin America, he gave emphasis to the

following factors: a) growth led by the domestic market; b) opportunity for greater regional integration; c) the risk from unfair trade.

Mr Gutiérrez believes that per capita steel consumption in Latin America will expand 4% in 2012, but with significant discrepancies between the countries, varying from 17% in Chile and Venezuela, 10% in Peru, 6% in Mexico, 2% in Brazil and Colombia and a fall of -13% in Argentina.

Latin American rolled steel production increased from 51.5Mt in 2010 to 54Mt in 2011. In accordance with the latest figures from Alacero, it will close 2012 with a production of about 55.5Mt. The steel trade deficit is expected to increase from 900kt in 2011 to 2.7Mt in 2012.

Nonetheless, the opportunity to strengthen steel trade within the region is very large: inter-regional imports of steel products are still very low. No Latin American country imports more than 50% from its regional peers.

In Alacero's view, the trade in manufactured goods with high steel content – or indirect steel trade – is considered the greatest challenge facing Latin American steelmakers and the metal-mechanical value chain. In 2010, the region's indirect steel imports reached 18.3Mt, against an indirect steel export of 12.2Mt. Thus, it had a 6.1Mt indirect steel deficit, which corresponded to an increase of 408% in comparison with the amount in 2000.

Mr Gutiérrez emphasised that the situation is in fact worst if bilateral trade with China is taken in consideration. In 2011, Latin American had a surplus of \$30bn of steel raw materials with China (blue line in **Fig 6**), a deficit in steel products lower than \$5bn (yellow line) and a massive deficit of \$38bn regarding manufactured goods containing a high content of steel (purple line). Definitely, the relationship with China continues to be a headache for Latin American steelmakers, which are waiting for better times. ■

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# CRU's 6th North American Steel Conference

The main focus of this year's North American Steel Conference organised by steel market analysts, CRU was the effect that the volatile costs of raw materials has on the price of steel in the USA. In passing, a mention was given to the second determinant of steel prices, 'disciplined' supply management, which has been largely made dysfunctional by weak demand and global excess capacity.

By Hans Mueller\*

DESPITE the inclusion of, 'North American' in the conference title, the steel markets in the neighbouring NAFTA countries of Canada and Mexico, entered only sporadically into the discussions. The few speakers from Canada confined their talks to company matters and specialised topics. There was a sprinkling of Canadian delegates but no speaker and only a single delegate from Mexico.

Topics discussed included the performance of service centres in volatile markets, the rapid expansion of US energy sources and what this means for domestic steel producers as well as the efforts of suppliers of competing materials to the automotive industry with lightweight solutions to raise the fuel efficiency of vehicles.

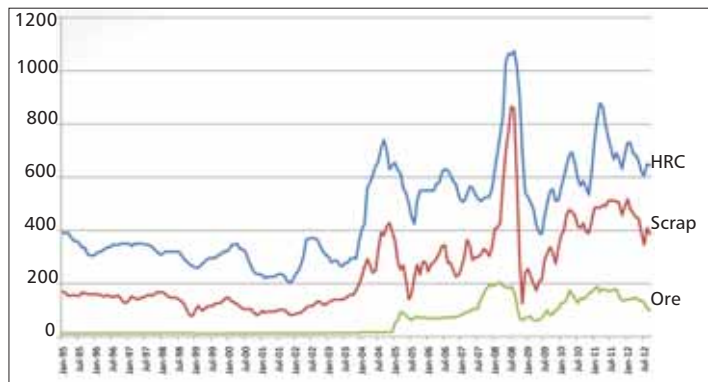
CRU team manager Paul Scott opened the conference with a brief review of three points of contemporary interest – China, steel pricing & financial derivatives, and shale gas.

On China, anticipating a talk given later by a CRU colleague, he noted that progressive urbanisation of China's society would allow for further growth of steel consumption in that country.

On pricing, he said the problem of increased price volatility along the steel supply chain could be mitigated by making greater use of derivatives and by overcoming supply-side resistance to this approach.

**Fig 1 Price volatility of scrap, iron ore and HRC (\$/st)**

Source: Gilmore Price basis: CRU –HRC US Midwest, Scrap –AMM #1 Busheling Index, Iron Ore –TSI 62% Fe CFR Tianjin



On the development of US shale gas extraction, the drop of natural gas prices from about \$7MBtu (million British Thermal Units) to under \$3 has caused some US miners to move more resources into the production of metcoal and, as yet with uncertain results, into exports.

## Service centres

The next three speakers represented large service centre processors (SC), all with operations beyond their national boundaries, the first with headquarters in the USA, the second in Germany and the third in Canada.

Geoff Gilmore, president of Worthington Industries, explained that his company derived a large share of its total income from activities other than simply selling steel, specifically steel processing, manufacture of pressure cylinders and vehicle cabs, as well as a series of joint ventures. He traced the beginning of high steel-price volatility back to 2004 (Fig 1), attributing some of the fault to the domestic EAF producers' method of including unstable scrap prices in the formula for calculating steel prices and to the integrated producers for going along with those prices. His company's response to the rising volatility of steel prices was to rely more heavily on HRC derivative contracts and he predicted a similar shift by other large steel buyers.

Mark Breckheimer heads the heavy carbon group of Germany's Klöckner Metals SE, which in 2011 merged its US division (formerly known as Namasco) with the large American Macsteel service centre chain. Considerable synergies were achieved by combining key sectors such as accounting and communications and the operation of truck fleets, warehouses and finishing operations. Additional benefits

resulted from boosting the enlarged company's purchasing leverage to 2.9Mst/y (million US short tons) and from retraining the entire sales staff to sell all products from any branch location, a capability preferred especially by large OEMs. Breckheimer said the enlarged US division, now called Kloeckner Metals, planned to move away from commodity products and focus more on advanced processing and collaborative consulting.

Carl Parker, procurement chief of Samuel, Son & Co, the largest Canadian SC (operating with 106 locations, most of them in NA), lamented the fragmented nature and slim margins typical of the NA service centre industry. He also said he observed a decline of industry sales in Canada and the northern USA in contrast to increased sales in southern USA and Mexico. As to the future, he hoped for a more pronounced recovery of the NA construction sector, continued 'industrial on-shoring' (firms bringing outsourced manufacturing operations back to NA) and availability of sufficient qualified workers. In general terms, he believed "there are still quite a few curves in the road ahead, but they are fewer and less severe than the road we just travelled".

The fourth speaker at this session was Lisa Goldenberg, operating officer with a mid-sized Pennsylvania distributor, who confined her talk to a few uplifting remarks about the importance of mutual understanding and of investing in America's youth.

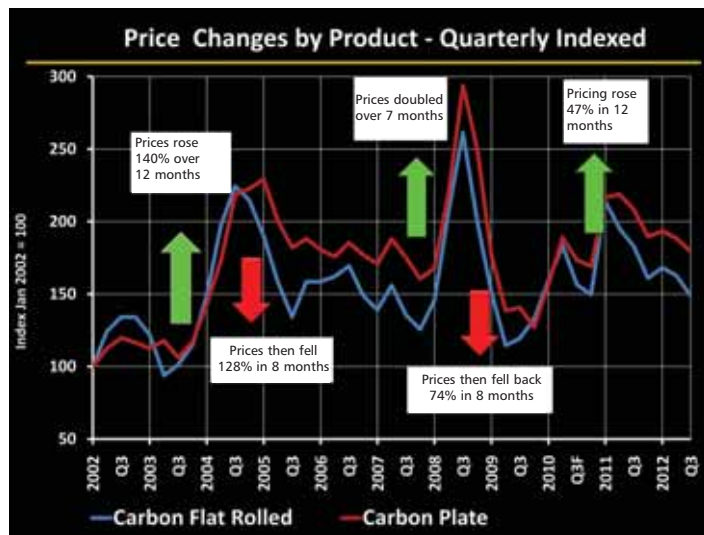
Moving from steel processors to a steelmaker, Guilherme Gerdau Johannpeter, head of Gerdau's 12Mt/y North American long-steel products division, described his company's phenomenal rise from its start 111 years ago as

## Who Came

Of the total attendance of 200 – not including 11 CRU speakers and organisers – 10 delegates came from Canada, two from China, two from Russia, and one each from Austria, Brazil, India, Mexico, Pakistan, Panama, Trinidad and Turkey. The total is close to that of 2011 (195) which was an improvement on the 119 attendees in 2010.

**Fig 2 Volatility of steel price for C flat rolled and C plate (Indexed)**

Source Parker



\*Steel economist e-mail tnconsult@gmail.com

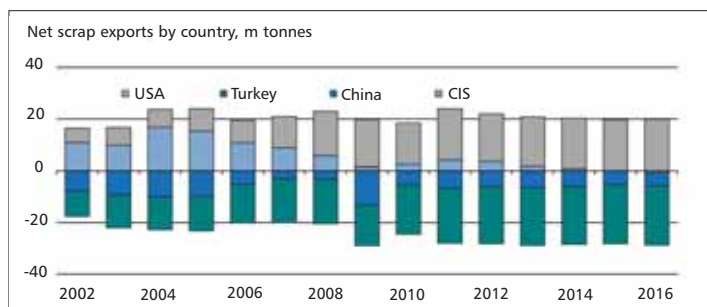


Fig 3 Net scrap exports by country Source: E Johnson CRU

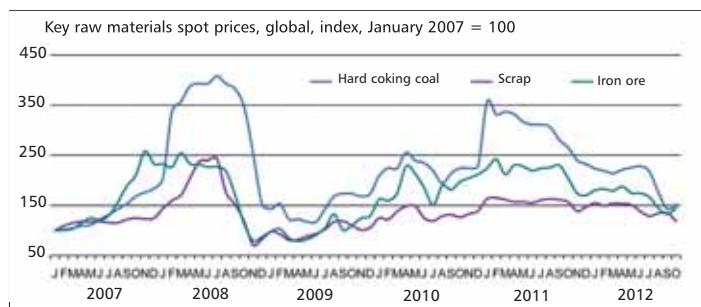


Fig 4 Scrap price for EAF steelmaking compared with integrated mill raw materials price Source: E Johnson CRU

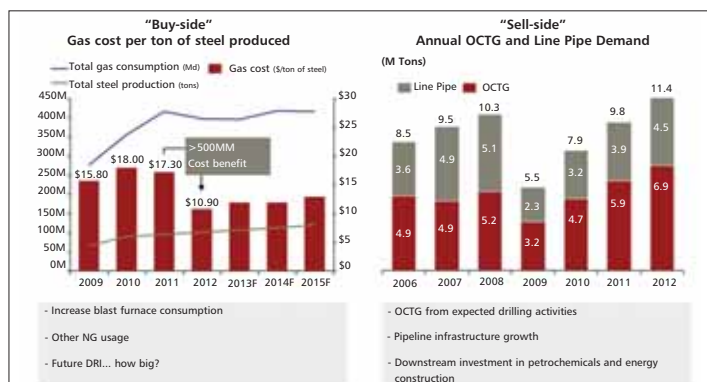


Fig 5 The US Shale gas bonanza benefits the steelmaker two-fold, lower operating costs and more tubular sales Source: Mehlretter of AT Kearney

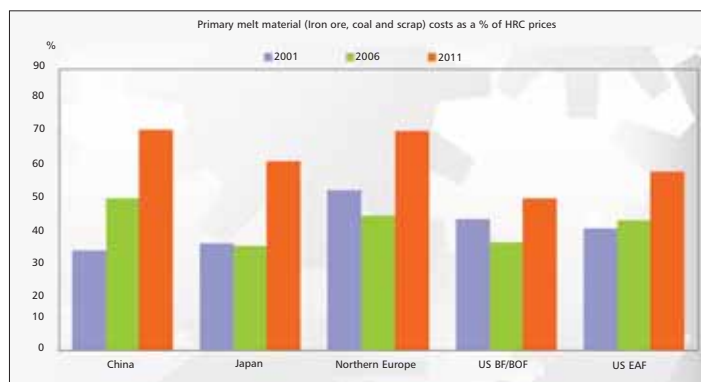


Fig 6 Cost of raw materials as a proportion of selling price of HRC by region Source: Parr KeyBanc Capital Markets

a small manufacturer in southern Brazil to a giant enterprise with operations in 14 countries and a total workforce in excess of 45 000. He pointed out that in 2011 the long-products division had achieved the highest EBITDA margin in the US long-products market – ahead of the USA's largest minimill group, Nucor, and its close competitor, SDI. He did not provide further details regarding the competitive conditions in this market. Weakening demand, in large part due to shrinking infra-structure spending, would narrow the margin in 2012. He called the dramatic fall in natural gas prices in the USA a 'game changer' that would give EAF steelmakers a cost advantage over most of their peers in other countries, including Brazil.

### Chinese steel demand

John Johnson, CRU's China expert, knows his subject well. He is aware that China's economic policy is currently moving down a dead-end road and that drastic changes will soon be required to ensure the country's economic health over the longer term. Whether in the ensuing conditions his predicted growth in steel-consumption of 4.8% a year between 2011-2016 will materialise in China is hard to tell at this time. There may also be a problem with Johnson's methodology of tying predictions about China's steel consumption to the US experience. For instance, in the USA per-capita steel consumption began to turn down when urbanisation reached 65-70%. But conditions in the two countries differ in one important respect, the historic design of the typical urban environment. In the USA, an ample layout allows most city dwellers to have a personal automobile. Few Chinese cities offer such spatial generosity, certainly not their new high-rise apartment districts. China's present rate of urbanisation is in the low 50%-range, but chances are that the country is

already finding itself close to the turning point as regards the impact of urbanisation on per-capita steel consumption.

### NA raw material & energy trends

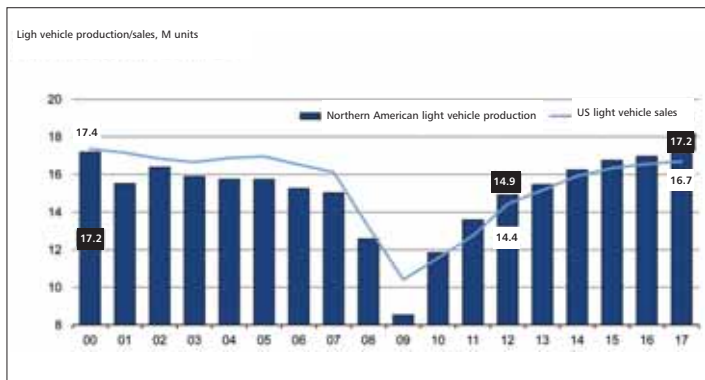
CRU consultant Elizabeth Johnson presented her perspective on changes in the US metallics market over the next several years, touching especially on questions of supply, demand, foreign trade and the development of prices. Considering that at its primary stage the US industry relies to a much greater extent than others on the EAF furnace, scrap will remain its most essential raw-material input. Both pig iron and DRI are not only scrap substitutes, they are also scrap complements that dilute the harmful effects of certain irremovable trace elements contained in scrap, copper in particular. (The need for complementary 'pure metallics' is specially pressing for minimills wishing to compete in the expanding markets for high-grade flat products). US pig iron imports are expected to decline during 2012-2016, as DRI capacity rises worldwide, including in the USA. The global demand for US scrap will be steady but recovery rates will have to remain high due to rising demand from domestic EAF mills (Fig 3).

Internationally, demand for imported scrap by Turkey will stabilise due to greater home-market availability. Whether an increase in the quantity of obsolete scrap in China will reduce that country's import demand was not entirely certain, according to Ms Johnson. Scrap prices would stay at high levels in the foreseeable future, having soared in the 2003/2004 period and again in recent years (Fig 4).

Steve Mehlretter of AT Kearney gave a brief account of the US shale-gas industry's rapid expansion and what this meant for the steel industry. So far this has benefited steel producers in two ways. It helps lower the cost of producing steel and it greatly increased the

demand for tubular products, both OCTG and line pipe. Additionally, if future NG prices remain at reasonable levels, steel producers will gain access to more domestically-produced DRI. The largest demand for NG will come from the electric power generating industry, which have aging coal-fired plants and are coming under pressure to spend large sums on environmental measures. Because the cost of refurbishing a coal plant is similar to converting it to NG, and the latter is environmentally less problematic, the power companies are keeping a close look at the price of NG. Furthermore, a widening spread between NG prices in the USA and prices in Japan and Europe may eventually lead to US exports of liquid NG to those areas. Ethylene, another product in which the USA has a cost advantage, is likewise being considered for export to Asia and Europe.

Mark Parr of KeyBanc Capital Markets provided additional information on the relationship between raw-material and steel prices. He drew attention to the fact that the dizzy expansion of China's steel industry during this century directly affected the prices of seaborne raw materials and thus the costs to steel producers in many countries who depend on such supplies. The US industry, notably its integrated sector, gained a cost advantage over many offshore rivals because it does not share this dependence and consequently stayed clear of the same radical cost surges. However, in recent years falling prices of seaborne iron ore and metcoal have eroded this advantage. In contrast, US minimills continue to benefit from paying lower prices for scrap than foreign producers. During the Q&A it seemed that Parr caught only the last part of a lengthy question from the floor as to why the US steel producers' prices were higher than those of foreign competitors even during the period when they enjoyed a significant cost advantage. In his



**Fig 7 Light vehicle production and sales in USA (million units)** Source: Edwards CRU- Data LMC Automotive & CRU

reply he referred to various cost-cutting efforts the mills had made at the time.

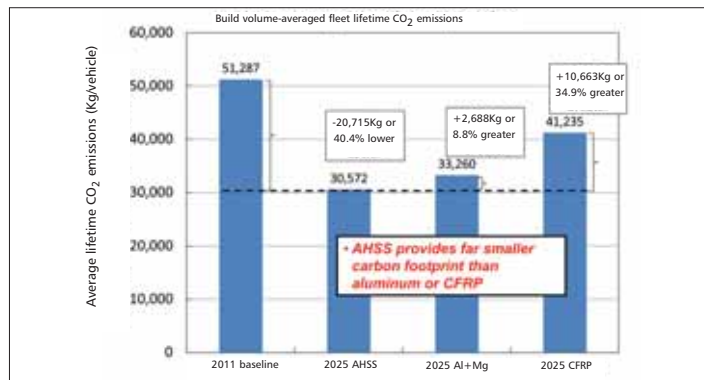
Paul Vivian, owner of Preston Publishing (a leading data source for tubular markets), assessed the demand for OCTG and line-pipe products. In his view, during the next ten years much of the demand for these products would come from the continuing exploration and extraction of shale gas and oil, 90% of which involved directional drilling. Rigs are becoming more efficient (more wells drilled per rig) and the amount of steel used per rig has been rising to about 280 stons. Moreover, a higher rig count will raise OCTG demand from the present 7.1Mst to 8Mst by 2020, increasingly for alloy, premium and semi-premium grades. With import penetration having moved beyond the 50% mark and domestic producers rapidly adding capacity, a clash looms in the years ahead. The demand for line pipe (LP) is segmented into small and large diameter (OD) products, with each accounting for half of total demand, estimated at 5Mst in 2012. Vivian expects the demand for both LP segments to increase in 2013, but small OD demand will show faster growth. Furthermore, he warned repeatedly that demand for OCTG and LP will continue to be highly cyclical.

**Short term demand**

On the next day, two speakers followed up with additional short-term projections. Rob Edwards of CRU made his forecasts on the assumption that the USA would manage to steer around the so-called 'fiscal cliff' of January 1, 2013, when temporary tax cuts enacted more than a decade ago would end. While higher taxes are needed to reduce the nation's enormous deficit, they would likely decelerate the US economic recovery. Edwards expected GDP to expand at less than 3% a year in the 2013-14 period, although both the residential and non-residential sectors would grow at a strong 7% annually over the next five years. Regarding the market for light vehicles (which includes small to medium-sized pickup trucks favoured by many Americans), the high average age of vehicles currently in use plus 'favourable demographics' would cause sales to reach 17M vehicles by 2017, recovering to its level in 2000 (Fig 7). He predicts that utilisation of steel-mill capacity will climb in 2013 as will the price of most steel products. Steel in the US would sell at a premium relative to Asia and Europe which would attract additional shipments from offshore mills and traders. Longer-term, however, US steel prices would weaken. The price of the largest product category, HRC, would drop below \$600/st.

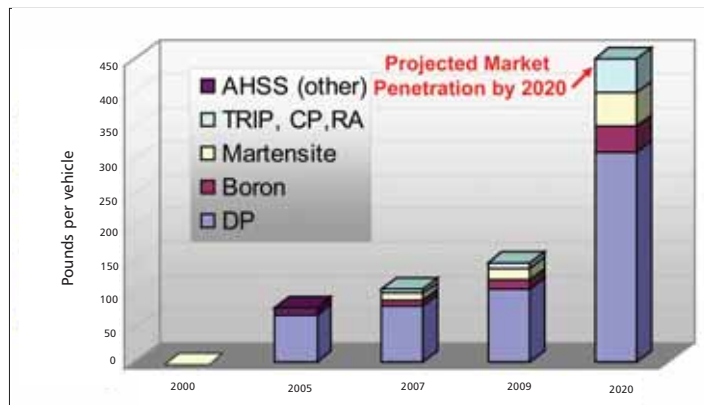
**Fig 8 2012 Fleet Lifecycle Greenhouse gas footprint assessment**

Source: Rastogi ArcelorMittal USA



**Fig 9 Growing use of advanced high strength steels in automobiles**

Source: Krupitzer



Timothy Hayes, of Davenport Equity Research, covered similar ground but focused on different economic sectors and steel products. The manufacturing and utilities sector, which grew at 20% in 2012, would show a much slower growth in 2013. Mining and petroleum, which had expanded at "blistering rates" in 2010 and 2011, would slow down to 4% in 2012 and to a slightly lower rate in 2013. The North American automotive sector would grow at more than 10% in 2012 and, 'conservatively estimated', at 5% in 2013. Within the steel industry, SBQ products will show a 7% demand increase in 2013, which will still leave this industry segment considerably below its high 2004-2007 average. HRC demand, already back to pre-recession levels, would further expand by 5% in 2013. Unlike the previous speaker, Hayes expected prices of selected products to decline in 2013, SBQ and HRC prices moderately, carbon-plate prices by a larger margin. He also noted what had already been pointed out in the first session, namely that US mills exacerbated market volatility by injecting widely fluctuating scrap prices into the pricing of steel products.

**Light weighting automobiles**

Showroom prices for new cars have risen considerably in the past five years. One reason is that more buyers expect cars to come with equipment that used to be optional at a higher price or that previously only came with luxury brands. Another is government mandates requiring greater crash resistance and increased fuel economy. If it were not for a US government ruling obliging vehicle producers to raise the average fuel economy of cars and light trucks to 54.5 miles per US gallon (about 23km/litre) by 2025, (CAFE regulations) it is doubtful that steel conferences would list an automotive session in their programmes. One subject on the mind of many car buyers – the extent to which this mandate will affect the price of new cars – did not come up at the

Chicago conference. Intent on defending steel's position in this market from inroads by other materials, one industry expert, P K Rastogi of ArcelorMittal USA, expressed the conviction that advanced high strength steels (AHSS) would have no difficulty in light weighting vehicles to lower their fuel consumption to the required level. Steel also came out on top, he added, when comparisons were made taking into account the CO<sub>2</sub> generated during the entire life span of a vehicle from raw-material smelting to recycling (dubbed life cycle assessment or LCA) (Fig 8). It is not clear to what extent this model applies to the US steel industry which produces nearly two-thirds of its steel by melting scrap rather than by smelting raw materials. At present, legislation considers only 'tail pipe' emissions produced during the 'in use' part of the cycle.

It became obvious that information was not yet available regarding the impact the fuel economy mandate would have on vehicle costs. Ronald Krupitzer, another US steel industry expert, talked about costs only at the micro level, for example, sizable cost differences between the techniques of rollforming compared with hydroforming when shaping sheet steel into body components. He also hinted at a lack of formability of some of the new high-performance steels – some of which require hot pressing – at least until the third AHSS generation comes to market. However, no major new equipment would be required to produce these superior grades, he assured the audience in the Q&A period (Fig 9).

Curt Horvath of General Motors said compliance with the fuel-economy mandate was only one of the major challenges facing his company. Another was building cars of sufficient strength to resist the impact of crashes from various directions. Attaining the increased strength would be harder when joining different materials, which would also raise problems with cycle times in the production process and with the recyclability of cars. Horvath concluded

ed his presentation with the declaration that for GM "everything is on the table" but left the impression that he might be a bit partial to steel.

Umesh Gandhi of Toyota held positive views on the use of diverse materials in vehicles and listed a number of applications – as in roof panels, liftgates and fenders – where such composites as glass fibre or carbon fibre reinforced polymers would perform satisfactorily. He acknowledged, though, that at this time composites were more intensively used in luxury and high-end rather than mid-range and economy vehicles.

Randall Scheps of Alcoa predicted that the average weight of aluminium in light vehicles would increase from the present 343lbs (156kg) to 550lbs (250kg) by 2025 and that Alcoa would have both the production capacity and qualified personnel to supply the auto industry with all grades of aluminium needed and also provide expert consulting services. (At the present production rate of 14.9M vehicles a year in the USA this requires 2.32Mt (metric) of aluminium which equates to 55% of Alcoa's current 4.227Mt/y global production). As could be

expected, he also undertook to deny most of the views and assertions expressed about aluminium earlier in this session, including the alleged results of comparative life-cycle pollution studies of this highly energy intensive metal to produce.

### Logistics and infrastructure

Neither of the last two speakers at this conference, Greg Shimonek of the Union Pacific Railroad and Dan McCarthy of the Canada Steamship Lines, could suppress the temptation to discuss at length the outstanding job their companies were doing, especially when compared to the performance of competing industries. Railroads are more fuel efficient and pollute far less than lorries per ton-mile of haulage, Shimonek pointed out. Moreover, unlike lorry operators, railroads managed to finance their infrastructure without public assistance.

McCarthy made clear that ships use even less fuel per ton-mile of freight and cause less CO<sub>2</sub> and noise pollution than either rail or road carriers. However, he regarded railroads more as partners than rivals, because to some extent

railroads and his company served the same customers. Both speakers displayed data providing detail about the large quantities of steel products and steel-related raw materials their firms transported. Shimonek also referred to his company's acquisition of hundreds of new rail cars but did not mention, possibly for lack of information, the steel-plate equivalent of these purchases and whether the plate was of North American or offshore origin. McCarthy's company operates a fleet of 72 ships, most of them modern self unloaders and more than a quarter consist of the large Panamax size. The ships take iron ore to the mills across the Great Lakes and coal destined for export down the St Lawrence Seaway. Some go out to sea to top off huge Cape-size vessels that are too big to dock fully loaded in US or Canadian ports. Most of the company's ships were constructed in China, and a few in Korea. ■

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## On the web - Stahl 2012 – Future starts with steel

The annual gathering of Germany's steel industry took place in Düsseldorf 8 & 9 November 2012.

The theme this year was the 'Future starts with steel'. As usual, technical presentations were held on the first day and were accompanied by an significant exhibition of 121 companies – a remarkable turn-out for a single day exhibition.

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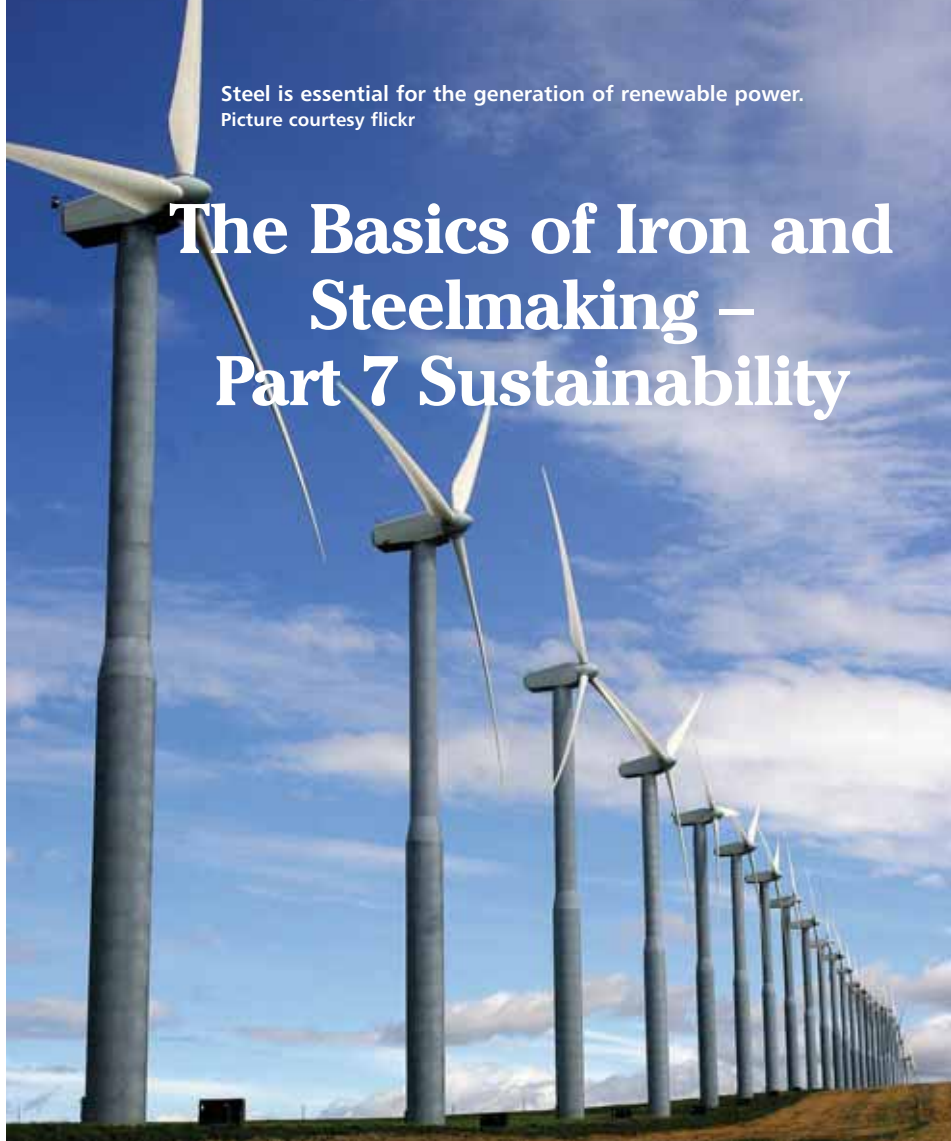
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In this, the last of the series of articles on the basics of steel production, Dr Walker looks at the sustainability of steel which encompasses Social, Environmental and Economic sustainability. He examines how the steel industry has eliminated waste in production and continues by examining how steel contributes to reduced energy requirements in products made from it. **By Keith Walker\***

CONCERN for the environment and the sustainability of industry has grown substantially over the last few decades and the steel industry is no exception to this trend. Making steel unavoidably produces CO<sub>2</sub> emissions and other waste products, as do most other industry. But for many years, reducing the amount of energy and raw materials required has been a focus of steel companies and has led to significant decreases. For example, the World Steel Association undertook a study of raw materials use in making steel on a global basis in 2008: 1.3 billion tonnes (bnt) of steel were made that year, which required 1.48bnt of raw materials, and it was shown that an additional 470bnt would have been required to make the same output in the 1970s. This equates to 1.12bn of CO<sub>2</sub> emissions being avoided in 2008 compared with the 1970s due to advances in control and technology. Indeed, in the past 30 years, the steel industry has halved the amount of energy required to produce each tonne of steel.

One of the key ways in which steel companies have reduced energy requirements is by using the various gases, which are produced by their operations, as fuel. For instance, carbon monoxide (CO) is produced by the blast furnace and also the BOF processes, which has been collected and used to re-heat steel for rolling in hot mills, for many decades in some plants. Waste gas collection plant is expensive but provides a substantial financial gain which is guaranteed. Indeed, there is often sufficient surplus gas to operate a power station, which not only generates all the electricity needed by the steel works but generates enough to export it to the grid.

These reductions in raw materials and energy continue today, now driven not only by cost but also the changing global concern over the use of the planet's resources. The so-called 'Resource Revolution' focuses on all resources, driven by increasing population and prosperity around the globe, but there is a conflict between economic growth in developed countries and sustainability. Since growth equates to increased consumption per capita, a shift in thinking is required, towards a reduction in the need for steel, and more re-use, as well as recycling. This shift is very significant and very difficult given how societies operate, being reliant on what amounts to unnecessary consumption of goods simply so that people can have jobs making them. This may sound incredible at first, but it is so. Indeed, the April 1967 edition of 'Reader's Digest' contains an article titled 'Waste Not, Have Not' which encourages waste on the basis that without it, many people would be unemployed.



# The Basics of Iron and Steelmaking – Part 7 Sustainability

And so, although there is, and always has been, an emphasis on recycling steel, there has been little focus on reducing the use of it. For example, in several countries the governments' response to the financial crisis and resulting down-turn was a financial incentive to scrap cars and purchase a new one – and, at least in the case of UK, this happened alongside claims to be the 'greenest' government ever in power.

There is also relatively little re-use of steel products, although re-use of serviceable rail has reached around 30% in the USA. It is technically easy to re-use many steel products but financial arguments tend to be against this due to labour costs outweighing the cost of new steel for a project. Again, new thinking is not only required but likely, driven by sustainability considerations.

## Recyclability

Recycling of steel has always been common, largely due to its ease. Since it is normally ferromagnetic (except for austenitic steels such as some stainless steels), it is easy to separate from other waste materials and requires substantially less energy to re-melt it back into steel products than does its extraction from ore. Unlike many other metals, steel can also be recycled many times to make products with the same technical properties. It is estimated that in the UK, 94% of steel construction products are recycled, and, on a global basis, around 68% of steel packaging is recycled. However, there is nowhere near sufficient scrap to meet the world demand for steel – it is still necessary to make around 75% of steel by smelting ore.

This means that around 25% of new steel

products made today are made from scrap steel (475Mt in 2008). Although there is often a good deal of talk of this being 'green', there is room for argument. Of course steel scrap should be recycled, but what does it tell us about the life of steel products when 25% of new ones are made from ones which have been scrapped? In short, the life is not very long. Given the unavoidable drivers from a sustainability viewpoint, re-use rather than recycling (re-melting) of steel products is likely to gather pace.

## CO<sub>2</sub> emissions

One other environmental driver affecting the steel industry is individual governments trying to meet their countries' emissions targets by forcing so-called 'smoke stack' industries into other regions. This is so in the European Union, where recent targets for steel industry emissions are set so low as to be regarded as technical unachievable. Of course, it matters little where in the world emissions are produced and the situation is rather less than rational as there is a risk of driving steelmakers in EU countries off-shore where the restrictions, if any, are less demanding. This is referred to as 'carbon leakage'.

## Life cycle analysis

There are other drivers which are also less than rational. For example, taxation of cars in the UK, USA and many other countries is based entirely on tail-pipe emissions. This drives manufacturers of automobiles to consider alternatives to steel to make cars lighter. It is a fact that the alternatives such as aluminium, magnesium

\*Dr Walker was formerly with Corus Group and is now MD of the steel consultancy SteelFolk e-mail keith.walker@steelfolk.co.uk

and carbon fibre composites use a lot more energy to make them in the first place and therefore produce more emissions, and also can be more difficult to recycle. To overcome this simplistic (and rather political) approach it is necessary to consider the entire life cycle of products. Taking a car, this would take into account all the materials and energy required to make it, its energy use during its life, and the impact it makes on the environment at the end of its life. Data are now available to support this sort of life cycle analysis (LCA).

The development of stronger steel strip products has greatly assisted in reducing the weight of steel cars over the past decade. Advanced High Strength Steels (AHSS) have enabled automotive firms to reduce the weight by between 17 and 25% compared to 20 years ago. Similarly, stronger steels have permitted much lighter packaging (eg beverage cans), cabling, white and yellow goods, to be produced.

### Use of 'waste' products

Steel production produces a considerable amount of waste in the form of slag. Slag is required during both iron and steel making to absorb the impurities which would otherwise render the products useless. However, by properly treating slag it is possible to use it success-

fully in road making or, in the case of blast furnace slag, cement manufacture, and this is very common.

Similarly, steelmaking produces a lot of dust and also scale (iron oxide which forms on hot steel). Many of these materials can be successfully recycled in the steel works to reduce raw materials needs and recover valuable products such as zinc (from galvanised steel scrap).

In conclusion, as the World Steel Association says: *'Steel is the core of the green economy'*. Steel is the main material used in delivering renewable energy, for example, the pylons, turbines and transmission lines for wind power generation.

It is used in solar power installations for mounting large arrays of solar panels and even as sheet coated with solar cells making them an integral part of a building. In tidal power projects it is essential for the structures needed to withstand an off-shore environment. And in conventional thermal and nuclear power stations, steels that can withstand increasingly high temperatures improve the efficiency of steam turbines so generating more power from less fuel. ■

For further information download the latest worldsteel Sustainability Report from [www.worldsteel.org](http://www.worldsteel.org)



Developing steels that can withstand higher temperatures improves the efficiency of power generation. Picture courtesy Siemens

## On the web - Metal-Expo2012: Sustainable growth in Russian steel

The annual Metal-Expo held each November in Moscow attracted a record 728 exhibitors from 35 countries and 35 000 visitors from 63 countries as well as VIPs from commerce and industry. Over 50 seminars and conference took place over the three-day event and the 1000 strong Gala Dinner was used to present awards for a wide field of achievements.

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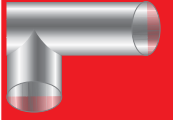
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# Henry Bessemer 200 years since his birth

By Fathi Habashi\*

THE 19th January 2013 marked the bicentenary of the birth of Sir Henry Bessemer.

Born in the village of Charlton, near Hitchin in Hertfordshire, UK in 1813 he is best known as the inventor of the Bessemer Converter which was arguably the first pneumatic bulk steelmaking process (Kelly in USA also laid claim to a pneumatic process at this time but it was never commercialised). Bessemer published his invention in 1856 and the first commercial application was seen in 1858. The process was still in operation worldwide well into the 1950s.

One of the truly great advances in the 19th century was the invention of steelmaking in a converter. Along with open hearth (Siemens Martin) steelmaking, over the next few decades it gradually replaced the tedious and expensive puddling process that took days to produce a few hundred kilograms of steel.

Steelmaking by the Bessemer Process was completed in about half an hour and it did not require fuel once the charge was molten as the heat was generated by the oxidation of the impurities present in the iron, mainly silicon and carbon. Many tons of pig iron could be transformed by simply blowing air through the molten iron. The reactor used became known as a 'converter' and the product became known as 'mild steel'.

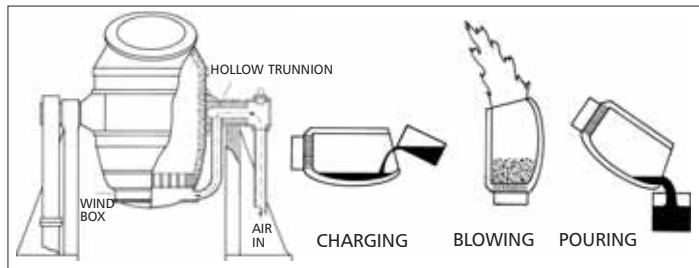
Henry Bessemer (1813-1898) demonstrated considerable mechanical skill and inventiveness early in life with 117 patents to his name. He learned metallurgy in his father's foundry and made numerous inventions such as a typesetting machine, an embossing machine for title deeds, and lead pencils. He also invented a new machine for sugar refining and made his first fortune selling 'gold paint' made from ground-up brass used as a paint additive in a process he developed and kept secret by not patenting it and swearing his workforce to secrecy. Bessemer's secret formula was used to adorn much of the gilded decoration of his time and brought him great wealth.

During the Crimean War (1853-1856) he invented a rotating artillery projectile that could be fired from smooth bore guns. The gyroscopic effect imparted to the projectiles in flight greatly improved the gunner's accuracy. Bessemer presented his concept to the British War Office, but was rejected, so he offered the idea to Napoleon III. On a December day in 1854 at Vincennes in France a demonstration was given. A senior officer expressed his concern regarding the much heavier propellant charge Bessemer had used, pointing out that such charges exceeded the French artillery's safety limit for solid cast smooth bore guns. Bessemer gave serious consideration to this warning and began a drive to develop a process for the mass production of inexpensive steel to make artillery gun barrels. He began his experiments in London with a vessel lined with silica refractory, a blowing engine, and a charge of pig iron smelted from imported Swedish ore.

Bessemer carried on experiments for two years before he evolved the essential idea of his process, which is the de-carbonisation of cast iron by forcing a blast of air through the molten metal. He made the first public announcement of the process at the Cheltenham meeting of the

British Association in 1858. It immediately attracted considerable notice. Many metallurgists were sceptical of his results on theoretical grounds, and only became convinced when they saw that his process was really able to convert molten cast iron into malleable iron in a perfectly fluid state.

A number of firms applied for licenses to work under his patents but failed to get good results. The steel produced was brittle, and it was not possible to cast large, sound ingots, free of voids. The latter problem was solved by the experienced metallurgist Robert Mushet (1811-1891) who added manganese in the form of an iron manganese alloy known as spiegeleisen to the molten steel to remove the oxygen dissolved in the metal, the cause of the voids. But when Bessemer tried again to induce ironmasters to



take up his improved system, he met with general rebuffs. He was driven to undertake the exploitation of the process himself and erected a steelworks in Sheffield in 1859 and began to manufacture steel. Gradually the size of the operation was enlarged and other steel manufacturers became aware that the firm of Henry Bessemer & Company was underselling them. Licenses were applied for and Bessemer received large sums in royalties.

But another problem faced Bessemer when it was found that the steel produced from iron made from most of the ores available in UK and Europe was still brittle even if the manganese alloy was added. This was due to the high phosphorus content of these 'basic' ores and it was only where pig iron made from 'acid' ores with low P content was available – such as parts of Sweden – that the process could be successfully operated. Indeed, the Swedish ironmaster, Göran Fredrik Göransson, the founder of the forerunner of the present day Sandvik company, was the first to successfully exploit the process at his Edsken steelworks at Sandviken in Central Sweden in 1857. He also made modifications to increase the volume of air blown but at a lower pressure.

The phosphorus problem was solved after 22 years in 1878, when the young Welshman, Sidney Gilchrist Thomas (1850-1885), showed that the addition of lime was necessary for the removal of phosphorus as a slag. However, to remove all the phosphorus, large amounts of lime must be added and this destroyed the siliceous lining of the converter. He, therefore, proposed making the lining from a refractory that is compatible with lime, namely, magnesia. The resultant process was known as the Thomas converter or Basic Bessemer. Thomas received



The Bessemer Gold Medal endowed by Bessemer is awarded for outstanding services to the steel industry



Sir Henry Bessemer (1813-1898)

The Bessemer converter and sequence of operation

Andrew Carnegie was the first to use the Bessemer converter in USA and protected his investment by buying the patent for the modified Thomas process to prevent its use for US basic ores. The illustration is a 10t converter c 1930 from A M Byers Co, Ambridge, Pennsylvania now displayed at Pittsburgh Station Square



the Bessemer Medal of the British Iron and Steel Institute in 1883, two years before his death at the young age of 35.

In 1879 the Royal Society admitted Bessemer as a 'Fellow' of the Society and the government honoured him with a knighthood.

To celebrate the bicentenary of Bessemer's birth the IoM3 are organising an exhibition at their headquarters in London at 1 Carlton House Terrace, from 19 January for three to four months as well as publishing an article written by a descendant of Bessemer in the January issue of 'Materials World'. ■

## Suggested readings

H Bessemer, An Autobiography, Offices of Engineering, London 1905. Available on Internet to download free of charge <http://archive.org/details/sirhenrybessemer00bessuoft>

F Habashi, Readings in Historical Metallurgy, Volume 1. Changing Technology in Extractive Metallurgy, Métallurgie Extractive Québec, Québec City, Canada 2006. Distributed by Laval University Bookstore, [www.zone.ul.ca](http://www.zone.ul.ca)

Henry Bessemer and the Development of Bulk Steelmaking <http://h2g2.com/dna/h2g2/alabaster/A83645526>

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