



Evolution of mining, processing, and operating characteristics in the maintenance of cost-effective ferrochrome production operations

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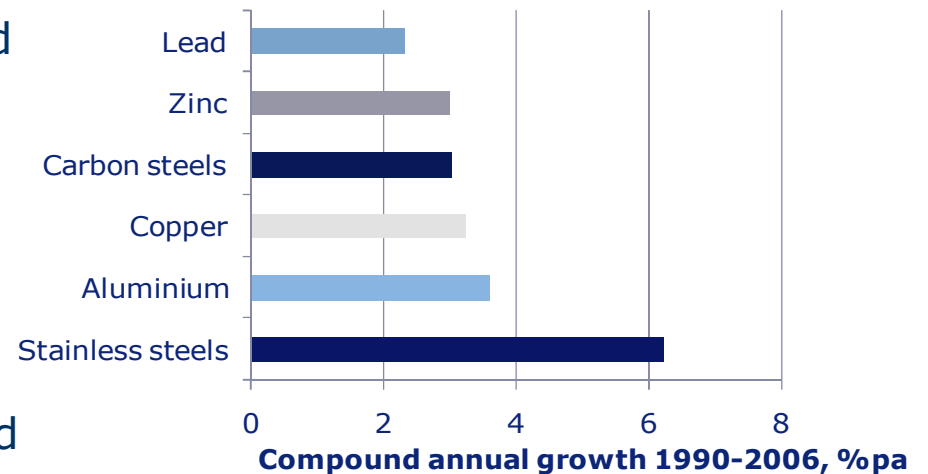
Setting the scene

Traditionally and rightfully considered a growth industry with relatively low barriers to entry and sound up-side potential in size and value prospects,

- Both chromite mining and ferrochrome production have grown, and evolved rapidly – the South African industry has been reasonably dominant in this area, though development in other regions of the world are certainly significant and are set to play a particularly important role as future trends shape the industry;
- Relative availability and pricing of Chromite ore, electricity and reductant supply dominate the alloy production arena and will individually each have had a role and will continue to feature in shaping the industry

Stainless steel ...from a sturdy past

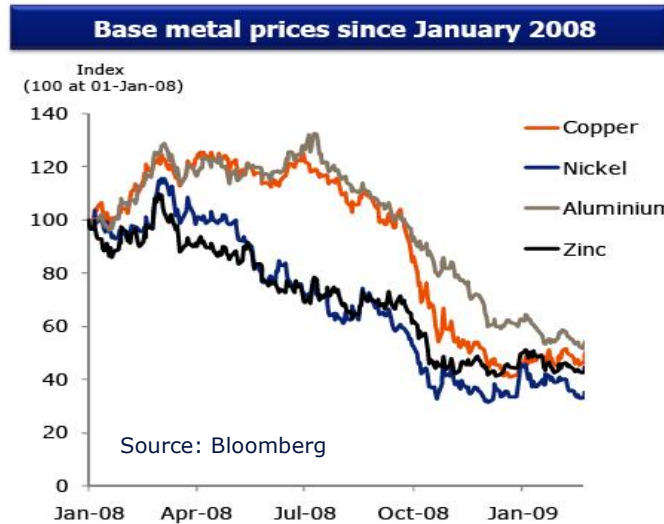
- The chrome industry – predominantly influenced by the fortunes of the largest end consumer being the stainless steel sector
- While the industry has experienced considerable market related changes over the last 2 years, growth has been particularly sound for a long historical period – certainly in commodity terms
- While all commodities are subject to marked volatility – there are certain fundamentals which had characterized the industry and that are certain to play a role in the future



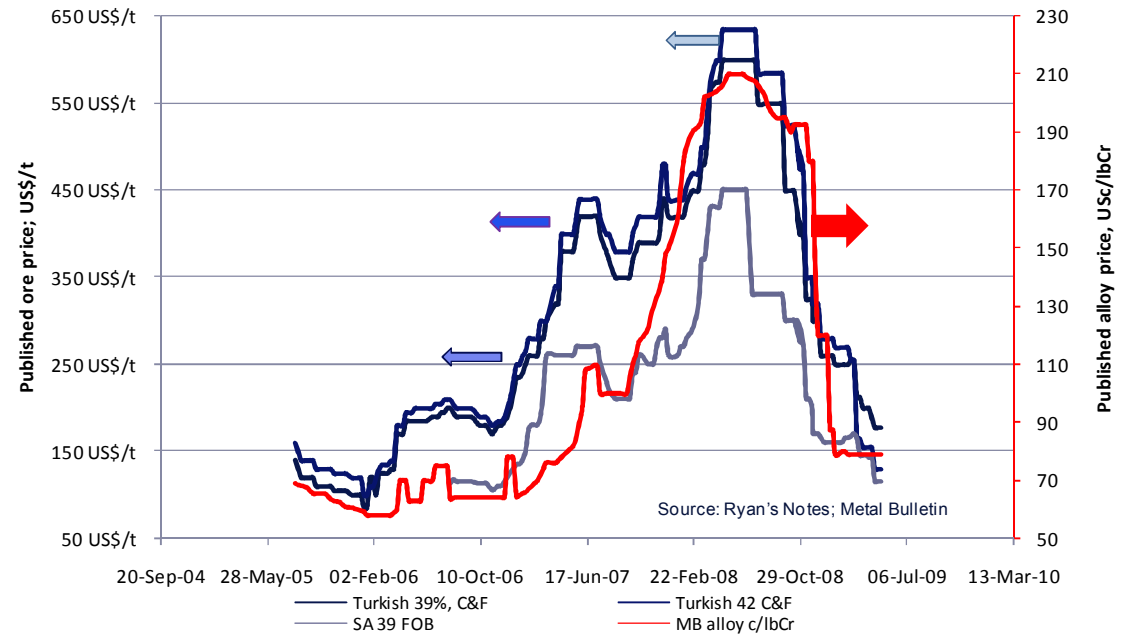
Ref: ISSF data analysis

A particularly dynamic period....

- As with all commodity industries, longer term trends are shaped in one or other way by fundamental cost drivers – these become particularly prominent in times of extraordinary turbulence in the commodity markets



Historical movement in chrome ore and Alloy prices



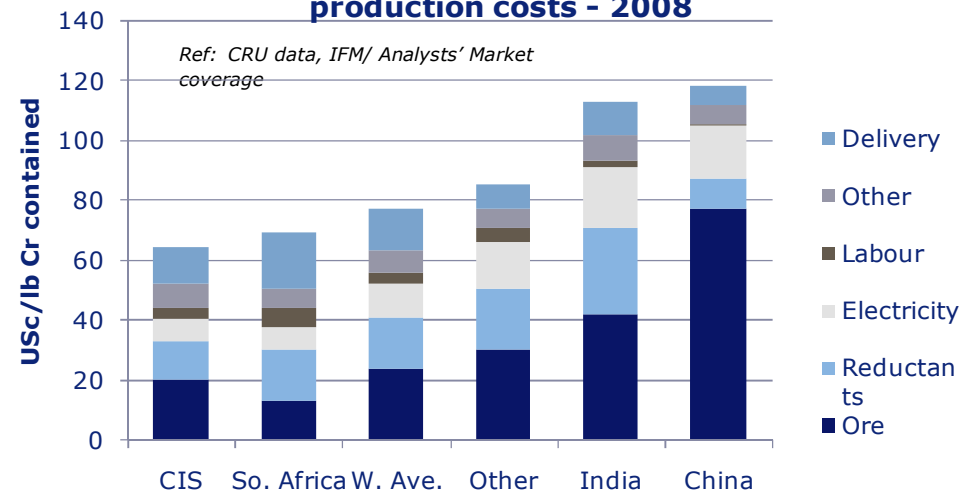
- Movements in chrome ore and alloy prices are not necessarily always well correlated
- But common to all major commodities, have seen a particularly marked decline over the last -12-18 months
- This sets the scene for the industry to examine itself particularly closely – many opportunities rest in such circumstances

Subtle shifts in certain key facets...

"It was the best of times, it was the worst of times; it was the age of wisdom, it was the age of foolishness;..." **Charles Dickens** *A Tale of Two Cities* (1859).

- Against tremendously 'dynamic' commodity pricing , with financial and currency markets equally unsettled, detail in cost and price structures is equally volatile – at best only indicative ;
- However of importance is the general trend of dominance of three particular components in FeCr alloy production
 - Ore cost – and naturally associated with this ore quality and inherent physical characteristics which influence smelting
 - Reductant costs – again together with certain added dimensions including tramp element profile
 - Electricity costs and availability profile

INDICATIVE profile of certain regional FeCr production costs - 2008



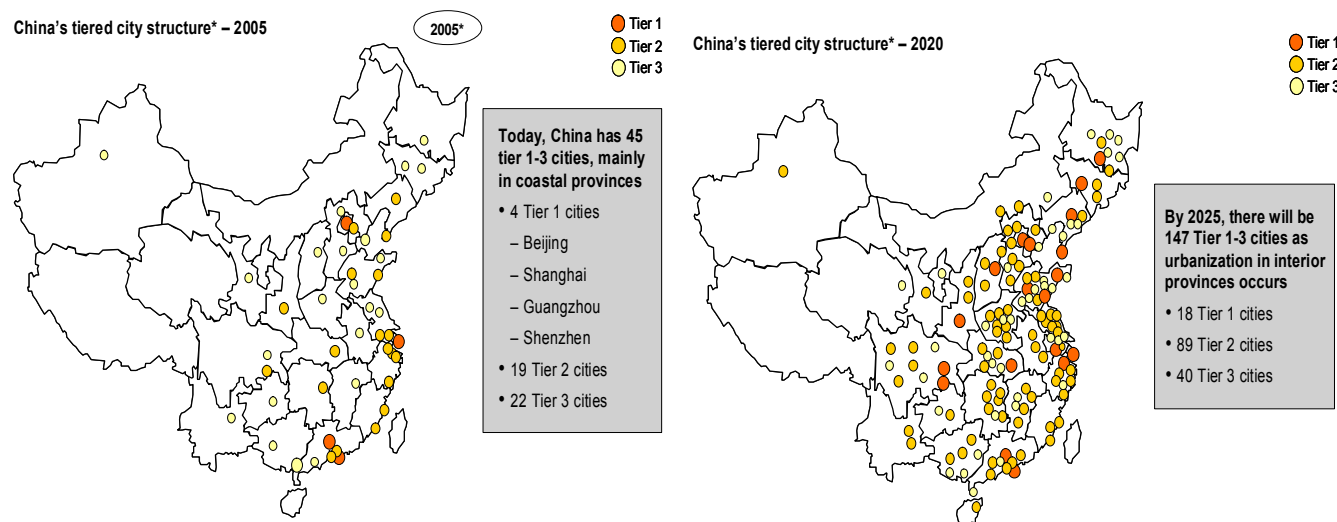
- Recalling the dynamic movement in ore prices seen earlier, certainly reductant prices have moved equally dramatically – the individual costs are certainly not static and only general reference is made to the trends

Much of the demand for commodities linked to fundamental physical demand, different to financial markets



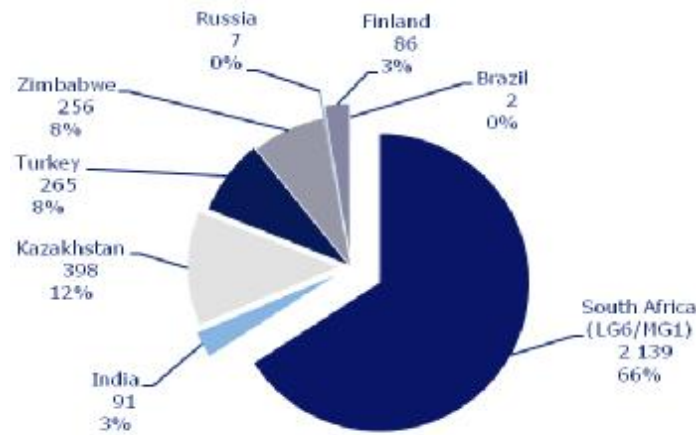
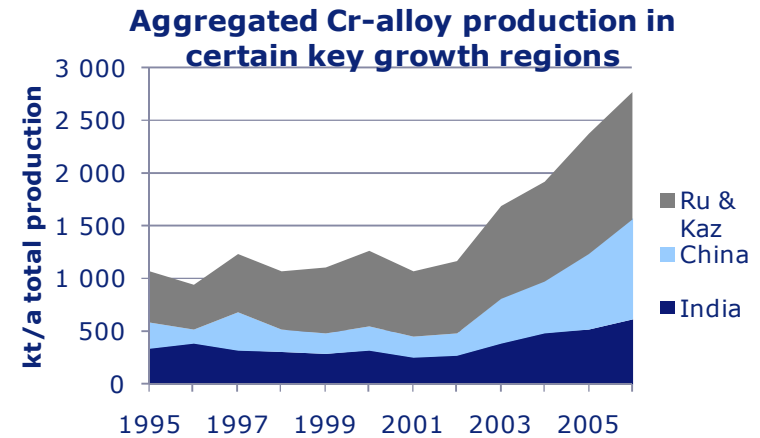
- Among the key drivers in the fundamental demand equation is the rapid urbanization in China, and in a similar context trends in development of India
- Not as integrated and exposed to conventional financial (US, EU dominated) markets , there is a measure of de-coupling which adds a measure of robustness to the demand;

350 million people – will be added to China’s urban population by 2025

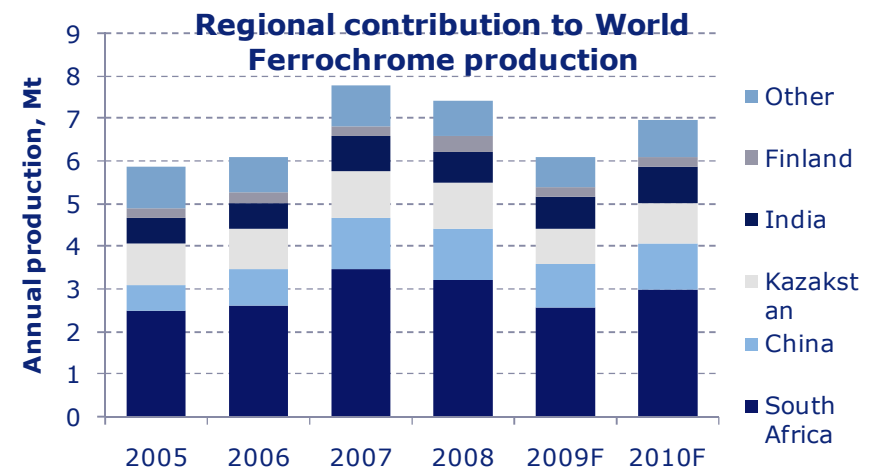


In dynamic circumstances.. What is constant?

- If against a somewhat turbulent background, with demand in certain regions supported by a range of fundamental aspects – production of alloy has grown
- Along with the demand for key ingredients mineral resource ingredients (Chrome ore and reductant;
- Supply of ore, reductant and electrical power are not necessarily co-incident with demand



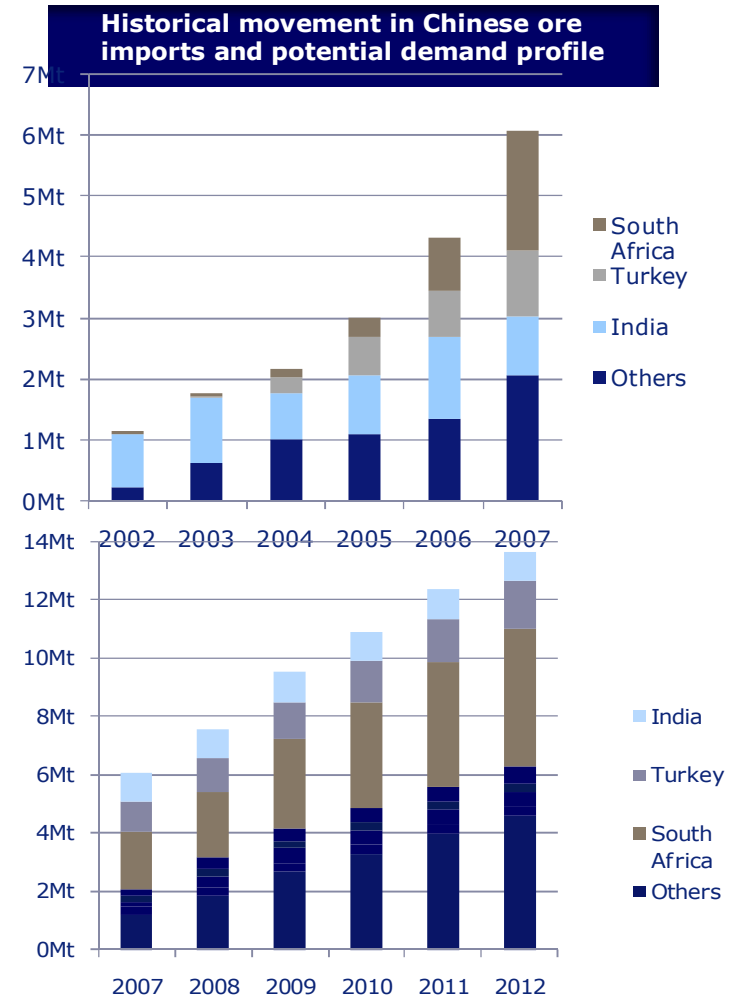
Source: Adapted from ICDA & USGS data



Source: CRU

The demand for ore in particularly China – and to an extent even India is a stimulus

- Growth in the FeCr smelting capacity in China and it's regional dependence on ore imports has resulted in a very rapid growth in ore imports to China
- Particularly significant in this has been the growth in South African Ore supplied to China – as opposed to the more traditional ore export sources – Turkey, India
- Contemplating the size of relative resources, supply from South Africa will be an influence in the future
- This has at least a two dimensional impact;
 - The grade of ore – SA ore being very definitely of a lower Cr/Fe ratio than ores from regions traditionally important in metallurgical ore exports;
 - The transport cost associated with ore movement from South Africa to China (land and sea components), together with port constraints domestically pose some interesting challenges
- Among other impacts, stainless mills with traditionally lower scrap ratios are going to most likely encounter a progressive shift in Cr & Fe unit supply profiles



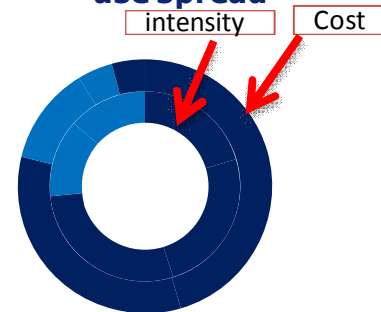
Source: CRU, China Trade stats, Uncomtrade

Different technologies and carbon type availabilities and pricing have an influence

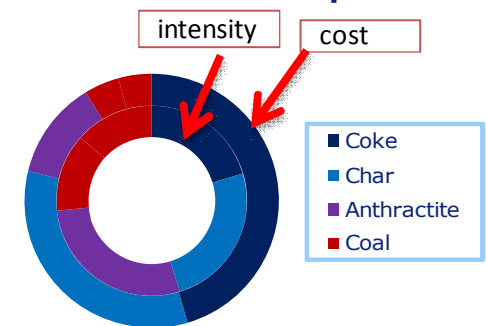
- Akin to the pressures on metals commodities, carbon reductant markets have broadly been broadly influenced by broad market trends, but coke prices have a steady base-line growth
- South Africa, India and many alloy producer regions face a measure of exposure to such reductant price moves
- Prices are however have a synthetic component related to the Chinese seaborne coke market with a specific license and export tariff structure;
- Future legislative and environmental pressures in this area will have an influence -flexibility in reductant type use and adequate spread of use type will assist in quality and cost control



Chinese typical reductant use spread



Multi-reductant use spread



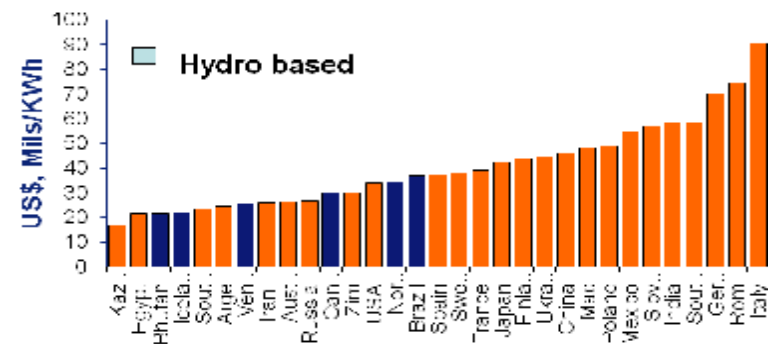
Source: ResourceNet CAMR

Electricity; Supply availability and cost – a differentiating factor

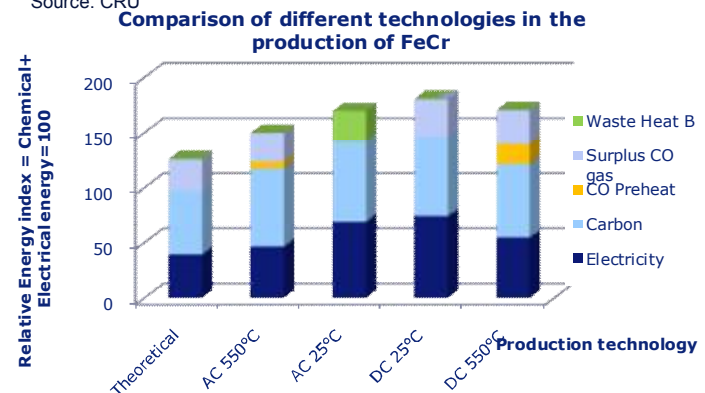


- Regional pricing has traditionally shown significant differential
- Dynamic circumstances in certainly China, India and South Africa have had a significant impact – and will continue to do so for the foreseeable future – price movements are not likely to show particular uniformity in escalation going forward;
- The specific aspect of regional energy pricing and availability, together with ore and reductant supply factors, will set the tone for the chrome industry in terms of growth and technology selection
- Energy efficient use of fines ores is a natural consequence – the industry trend towards pelletized, sintered and in cases pre-heated feeds are a logical development, as is pre-reduction under the appropriate circumstances

Electricity pricing profile - 2008



Source: CRU



Source: Adapted - OEC Technical information-InfaconX

A summary of the influences

	Force component	Ongoing developments
Ore	<ul style="list-style-type: none"> ▪ Robust demand from Chinese non-integrated producers ▪ Complex supply logistics with potential for disruptions ▪ Independent Ore producers evolving, a number with limited ore resource base 	<ul style="list-style-type: none"> ▪ Adaptations to broader use of lower Cr/Fe ratio ores ▪ Continued focus on extraction and conversion efficiency ▪ Independent producers not linked to ore supply likely to remain dispersed
Reductant	<ul style="list-style-type: none"> ▪ Base-line pressure on prices to remain for stable species (coke, chars); 	<ul style="list-style-type: none"> ▪ Progressive moves to reduce dependence on specific types – technology selection for capacity expansions will be influenced by this to a greater extent ▪ Similar generic responses to the ore situation
Power	<ul style="list-style-type: none"> ▪ Regional pricing framework pressures will change differentially and progressively influence the production and expansion environment 	<ul style="list-style-type: none"> ▪ Focus on power efficient technologies will be a relatively universal theme, guided by ore and reductant type and availability constraints

Concluding comments

- The industry has developed rapidly and has experienced significant changes over the last 25 years
- Developments in South Africa, originally centered around progressively increasing furnace size and numbers of furnaces – stimulated by abundant raw materials with sound cost profiles
- The industry remains relatively un-linked in a corporate context to downstream processing – and is certainly facing a variety of differentiating dynamics – regional consumption of alloy, and ores are shifting, power supplies and reductant pricing are also shifting – historic factors influencing industry growth and location will see changes over the next 25 years –