Equities

18 May 2012 | 140 pages

Global Iron Ore

Pumping Iron II

■ Industry Overview

- **The second global iron ore report** – The conclusions from our global study are: 1) the iron ore market has more cost support than we previously thought; 2) Value in use is likely to reemerge as a driver over coming years; 3) Supply is coming but at lower returns; 4) Quality companies with quality assets should outperform; and 5) No change to our forecasts, we remain above the forward curve.

- **Iron ore production costs heading higher** — Citi analysts cover 80% of the current global traded iron ore market and around 90% of additional supply. We have used this data to construct a bottom-up cost curve for the industry. The analysis points to a steepening of the cost curve over the next five years and, critically, it point to a rise in the cost of producing domestic Chinese iron ore. The 90th percentile is likely to rise from around $105/t to $125/t by 2015, while the top end of the cost curve could rise from around $135/t to $160/t.

- **Costs should support prices** — The high-cost capacity in China would have to be taken out for a significant correction in the iron ore price. This looks unlikely; we calculate that even under flat steel production in China it would take to 2014 for the high-cost capacity to exit the market.

- **Iron Ore prices are affecting marginal demand** — The ability to steel producers to pass through raw material prices has diminished significantly. Therefore, **Value in Use** is likely to be more important. We expect a reversal of recent trends to lower-quality products and towards steel mills optimizing their operations and focusing on quality of product. This bodes well for those iron ore miners producing the best quality iron ore product.

- **Incremental supply coming** — Citi has historically underestimated the supply of iron ore; however incremental supply was delayed and not cancelled. We forecast the seaborne market to grow by an additional 276Mt up to 2015; Australia and Brazil are likely to dominate the incremental supply to the seaborne market. Investors need to be careful and not complacent, the supply response is increasing in certainty, but the capital to deliver these projects is rapidly increasing.

- **Global stock recommendations** — Our key theme for stock recommendations in the mining industry is based on **sweating for success** against the **super cycle sunset**. We look for those companies that are low on the cost curve, generate higher returns and efficiently deploy capital. We compare the profitability of the iron ore companies on a Value in Use basis along with the capital intensity of the company. This highlights Rio Tinto, BHP Billiton and London Mining as stocks offering high-quality product, strong profitability and an attractive valuation. While Kumba is highly profitable with good ROA it is the most expensive stock in our coverage.

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See Appendix A-1 for Analyst Certification, Important Disclosures and non-US research analyst disclosures.

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Executive Summary

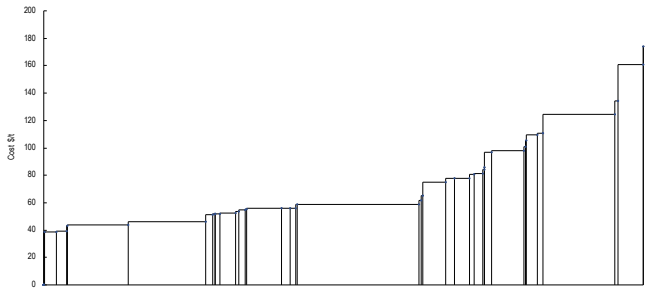
The conclusions from our global study are: 1) the iron ore market has more cost support than we previously thought; 2) Value in use is likely to reemerge as a driver over coming years; 3) Supply is coming but at lower returns; 4) Quality companies with quality assets should outperform; and 5) No change to our forecasts, we remain above the forward curve..

Iron ore costs increasing…

The 90th percentile is likely to rise from around $105/t to $125/t, while the top end of the curve is set to move from c.$135/t to c.$160/t

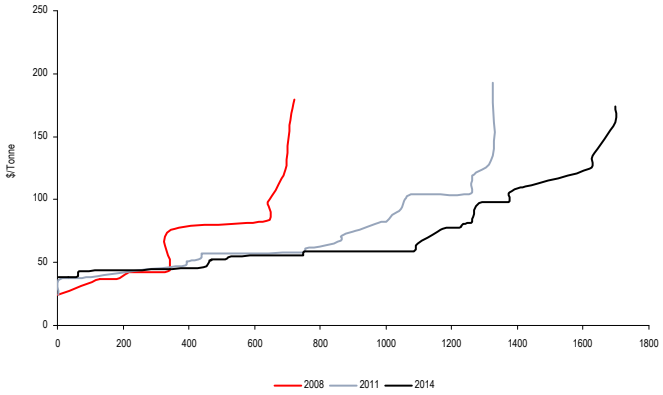
Citi analysts cover 80% of the current global traded iron ore market and around 90% of additional supply. We use this data to construct a bottom-up cost curve for the industry. The analysis points to a steepening of the cost curve over the next five years and, critically, it points to a rise in the cost of producing domestic Chinese iron ore.

Figure 1. Citi 2014E Iron Ore Cost Curve CIF China



Source: Citi Investment Research and Analysis

Figure 2. Iron Ore Cost Curve CIF Over Time ($/t)



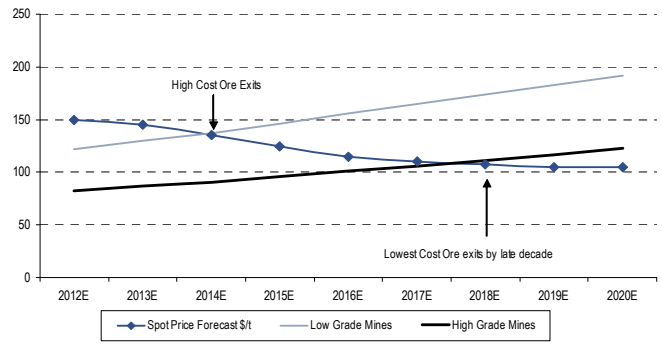
Source: Citi Investment Research and Analysis

…which could support Iron Ore Prices

High cost Chinese capacity needs to be eliminated before a serious correction in the iron ore price.

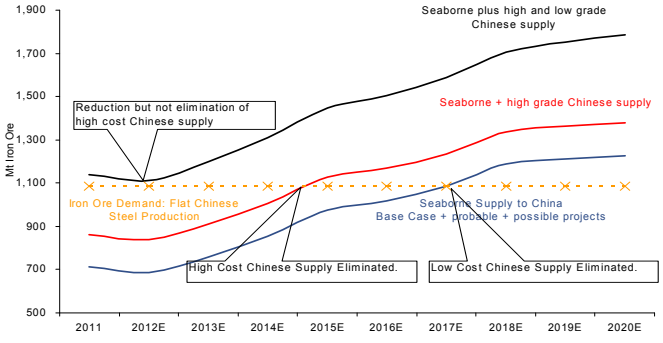
The high cost Chinese capacity would have to be taken out for a significant correction in the iron ore price. As Figure 3 shows, the forward curve implies this will occur in 2017/2018. However, as Figure 4 illustrates for this to come about requires not only flat steel production in China but the addition of all probable and possible projects on an unrisked basis to our seaborne supply. It would then take to 2014 for the high-cost capacity to exit the market, with low-cost Chinese capacity exiting by late decade. We run various supply/demand scenarios on page 21.

Figure 3. Chinese domestic costs vs. consensus iron ore price



Source: Citi Investment Research and Analysis

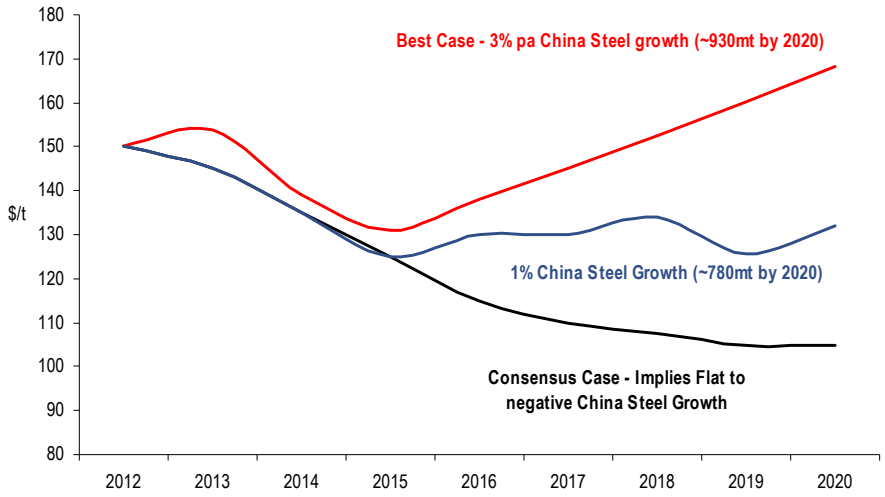
Figure 4. Consensus implied China supply/demand scenario



Source: Citi Investment Research and Analysis

The chart shows the potential price implications from varying supply demand scenarios. Our best case is based on Chinese Steel growth of 3% per annum, while the worst case – which consensus price forecasts imply – assumes zero/ negative Chinese steel production growth

Figure 5. Potential Price Scenarios



Source: Citi Investment Research and Analysis

However, cost of production is not the only driver

The cost curve is not the only factor in determining prices however; we also need to look carefully at demand and the margins made by steel mills

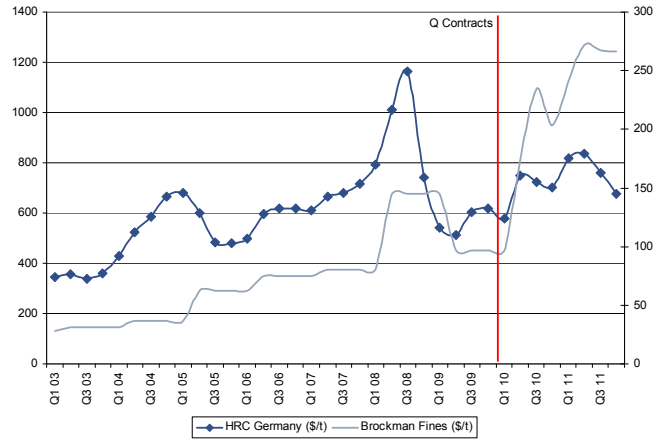
A critical problem in just basing the iron ore price forecast purely on the cost curve is the fact that it doesn't take into account demand. Historically, there has been a strong argument that raw material costs are a direct pass through for the steel producers, we however, would argue this no longer applies. The cost pass through arguably only works under a scenario of annual price negotiations and/or high utilisation rates, as these conditions no longer exist and both the steel and iron ore markets have evolved to 'real time' and spot markets we think this dynamic has changed and is likely to offset the steepening cost curve.

Therefore, Value in Use is likely to be more important

We expect margin pressure at steel mills to force them to drive efficiencies and optimization; using higher-quality ore is likely to play a role in this

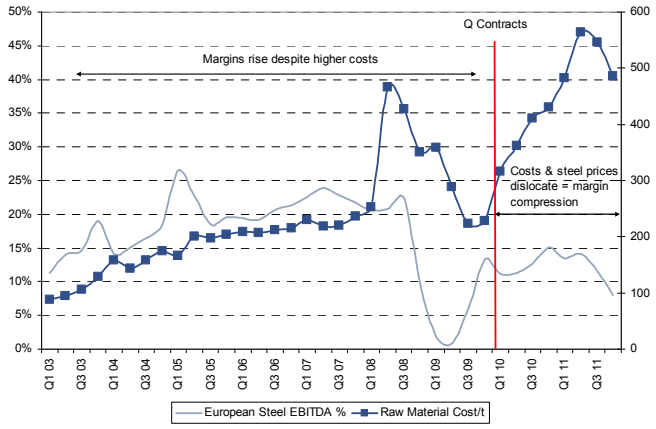
The trend to date has been a rerating of lower quality iron ore products in particular fines and magnetite ore. We expect this to reverse over the coming years given the margin compression and lower profitability that has occurred in the steel industry. We think under this scenario Chinese mills would resort to optimizing their operations and focusing on quality of product. At this juncture the 'value in use' argument comes into play, which bodes well for those iron ore miners producing the best quality iron ore and not so well for those that currently benefit from strong pricing but actually sell an inferior product.

Figure 6. Steel Companies Rode The Chinese Steel Contango



Source: Citi Investment Research and Analysis

Figure 7. Profitability Has Been Suppressed



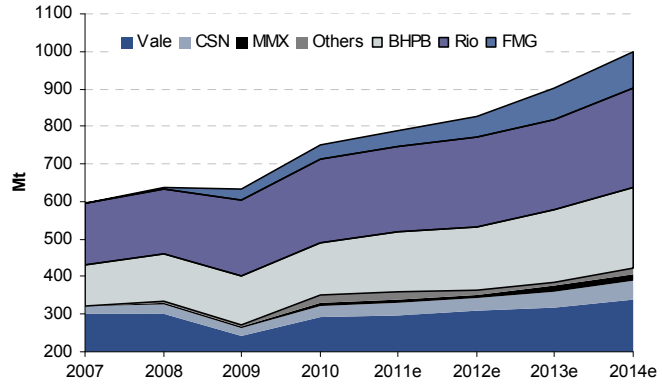
Source: Citi Investment Research and Analysis

Incremental Supply Looming – Brazil, Australia and China

Historically, Citi has underestimated iron ore demand by around 200-300Mt for the period of 2009 to 2011. On the supply side, Citi was generally more accurate in forecasting Australian iron ore supply, in contrast Citi significantly overestimated the supply response from Brazil by 50-60Mt.

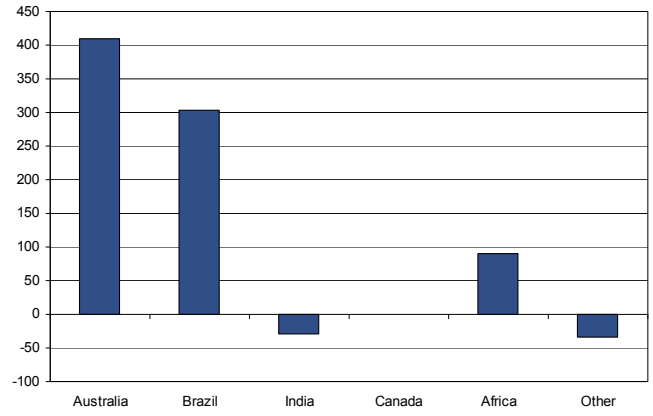
Going forward, we forecast the seaborne market to grow by an additional 276Mt up to 2015, Australia and Brazil are likely to dominate the incremental supply to the seaborne market. The supply response is increasing in certainty, but the capital to deliver these projects is rapidly increasing.

Figure 8. Iron Ore Exports from Brazil and Australia (Mt)



Source: Citi Investment Research and Analysis

Figure 9. Global Iron Ore Exports – expected by 2020



Source: Citi Investment Research and Analysis

Iron ore price forecasts

We recently made changes to our iron ore price forecasts in the **Q2 2012 Industrial Commodities Update** and we have therefore haven't made any changes to our forecast on the back of this report. We still believe that the Chinese economy will continue its measured slowdown and that construction activity and fixed asset investment will be supportive of steady growth in demand for iron ore. When combined with only near-trend growth in exports from Australia and Brazil and weakening exports from India, we continue to see the market in an implied deficit.

But the iron ore market remains at an important juncture. Chinese steel production recovered strongly in April but if the Chinese housing market continues to sour, steel and iron ore demand could come under further pressure later this year.

Figure 10. Base Case Supply/Demand Market Balance and forecasts

Mt	2009	2010	2011e	2012e	2013e	2014e	2015e	2016e	2017e	2018e	2019e	2020e	2021e
SEABORNE IMPORTS	902	996	1,028	1,059	1,107	1,207	1,284	1,407	1,524	1,604	1,678	1,750	1,795
% change y-o-y		10.4%	3.2%	3.0%	4.5%	9.0%	6.4%	9.5%	8.3%	5.3%	4.6%	4.3%	2.6%
SEABORNE EXPORTS													
Total	871	966	1,028	1,031	1,093	1,202	1,308	1,422	1,538	1,639	1,709	1,783	1,816
% change y-o-y		10.9%	6.4%	0.3%	6.0%	10.0%	8.8%	8.7%	8.2%	6.6%	4.3%	4.4%	1.8%
Iron Ore Price Forecast - TSI $/t	88	147	168	149	138	130	125	115	110	105	105	105	102

Source: Citi Investment Research and Analysis

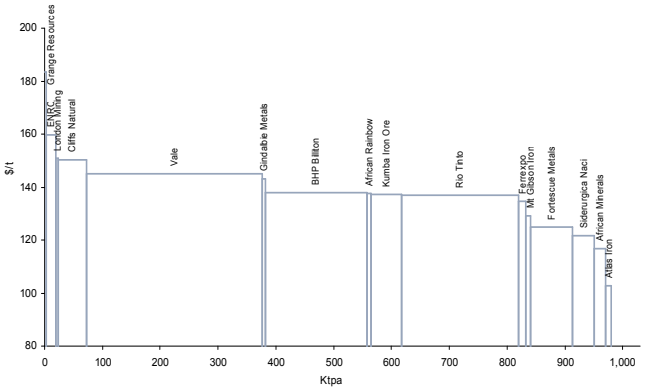
What does this mean for stock recommendations

We look for companies which are low on the cost curve, generate higher returns and efficiently allocate capital

Our key theme for stock recommendations in the mining industry is based on **sweating for success** against the **super cycle sunset**. We look for those companies that are low on the cost curve, generate higher returns and efficiently deploy capital.

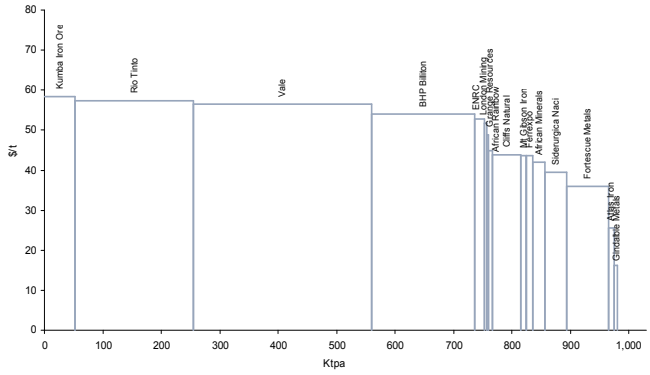
We compare the profitability of the iron ore companies on a value in use basis along with profitability and capital intensity.

Figure 11. Product Quality – 2013E Average Realised Price Pre Freight



Source: Citi Investment Research and Analysis

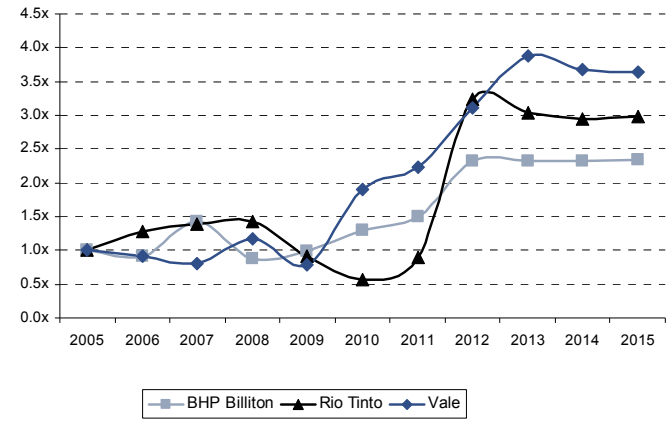
Figure 12. Iron Ore 2013E EBITDA/t Post Tax



Source: Citi Investment Research and Analysis

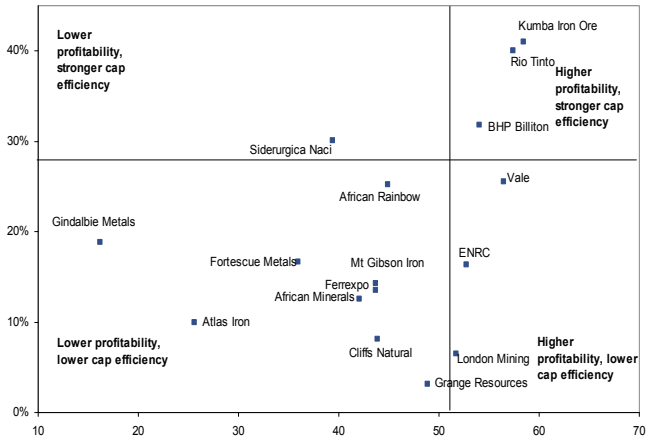
We have also taken into account the level of sustaining capex required to maintain existing production; Vale is spending significantly more than Rio and BHP just to 'stand still'. The stocks that offer investors defensive growth and above-average-profitability as well as efficient capital deployment are highlighted in Figure 14 below. Only Rio Tinto, BHP and Kumba offer a combination of the two elements.

Figure 13. Indexed Sustaining Capex / Indexed Iron Ore Production



Source: Citi Investment Research and Analysis

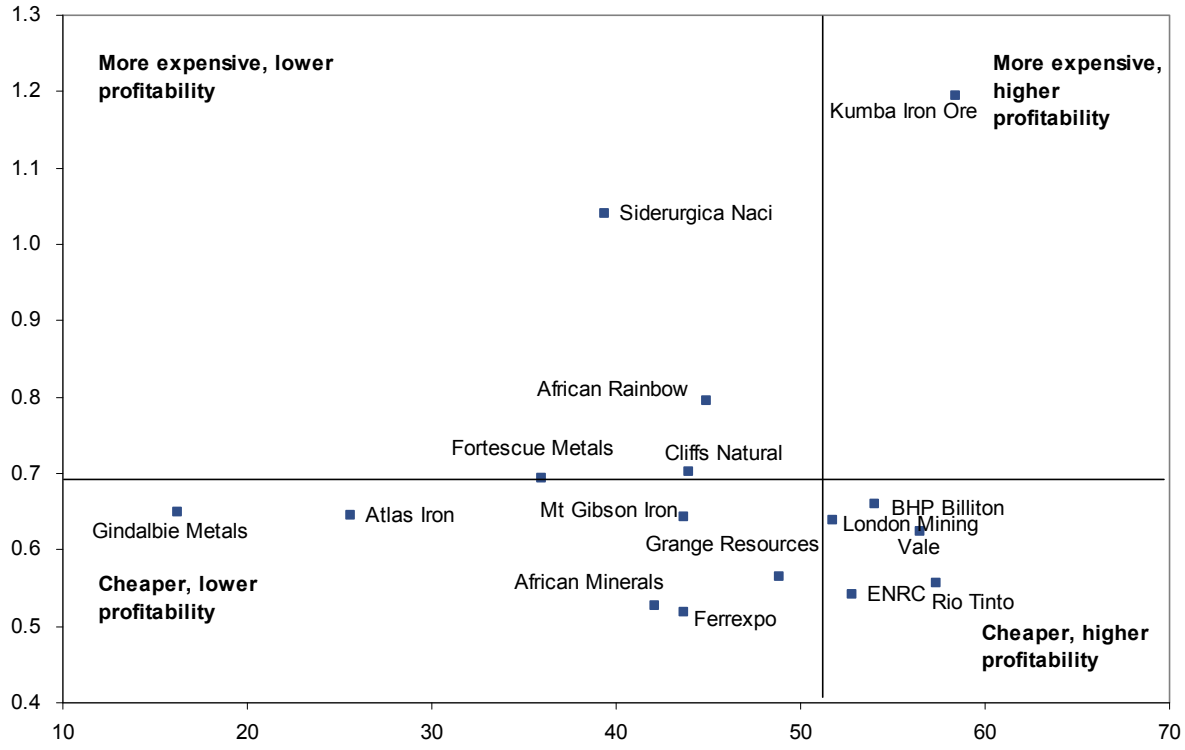
Figure 14. Average ROA% (Iron Ore Only) vs EBITDA/t post tax ($/t)



Source: Citi Investment Research and Analysis

On a more actionable, short-term basis, screening on current pricing and profitability highlights Rio Tinto, BHP Billiton, London Mining and ENRC, as stocks offering strong profitability and an attractive valuation. While Kumba is highly profitable with good ROA it is the most expensive stock in our coverage.

Figure 15. P/NPV vs EBITDA/t post tax 2013E ($/t)



Source: Citi Investment Research and Analysis

Iron Ore Hyperlinks

Sector reports

Metals & Mining - Sweating for Success

European Steel Equities - Prefer Voestalpine for 1H12, ArcelorMittal for 2H12

Q2 2012 Commodity Update - Unfolding Tail Risks…

Company reports

Gindalbie Metals Ltd (GBG.AX) - Financial Results and Changes to Reporting

Ferrexpo PLC (FXPO.L) - Pieces of the Jigsaw

Rio Tinto PLC (RIO.L) - Slow Start, but 2012 Production Guidance In-line with Estimates

Fortescue Metals Group Ltd (FMG.AX) - Production Weaker, but Iron Ore Upgrades Offset

Grange Resources Limited (GRR.AX) - 1Q12 Production – Record Shipments, Southdown DFS Due Soon

Kumba Iron Ore Ltd (KIOJ.J) - Disappointing Sishen production, Sell maintained

African Minerals and London Mining - Pumping Iron

Cliffs Natural Resources Inc. (CLF) - Eyes on Canada, Pushing Bloom Lake Cash Cost Below $60/Tonne and Turning Around Wabush

Mount Gibson Iron (MGX.AX) - March Quarter Production – Upgrade to Buy

Atlas Iron Ltd (AGO.AX) - Rolling out the Growth

BHP Billiton PLC (BLT.L) - Staggering Capex Key to Increasing P/E

VALE - Balancing The Budget: Should Vale "Live Within Its Means"?

African Rainbow Minerals (ARIJ.J) - Attractive iron ore exposure at a discount price

Eurasian Natural Resources Corporation PLC (ENRC) (ENRC.L) - Weak Q1 production, but no further costs/capex blowouts

Companhia Siderurgica Nacional (CSNA3.SA) - 1Q12 Weaker Than Expected. Iron Ore Capex Still Low. Sell.

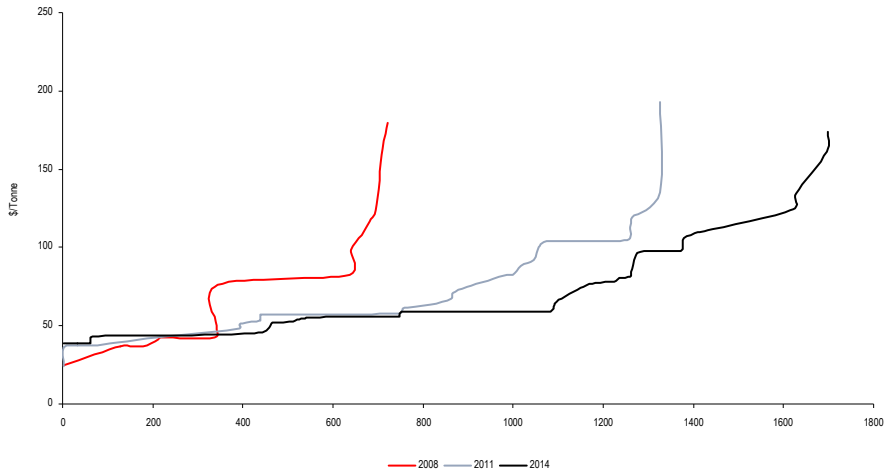
Global Iron Ore Cost Curve

We have completed a bottom-up analysis on the cost of production for iron ore globally; including a detailed analysis on the Chinese domestic iron ore production. We conclude that the iron ore price has significant cost support from the high-cost Chinese domestic production. Our analysis suggests that iron ore is likely to be priced off the high cost domestic Chinese production for some time to come. Even under a flat steel production environment in China, the Chinese high-cost domestic production will provide a floor until 2015 and potentially even up to 2020.

Our analysis points to a steepening of the cost curve over the coming years, with the 90th percentile moving from ~$105/t to $125/t by mid-decade

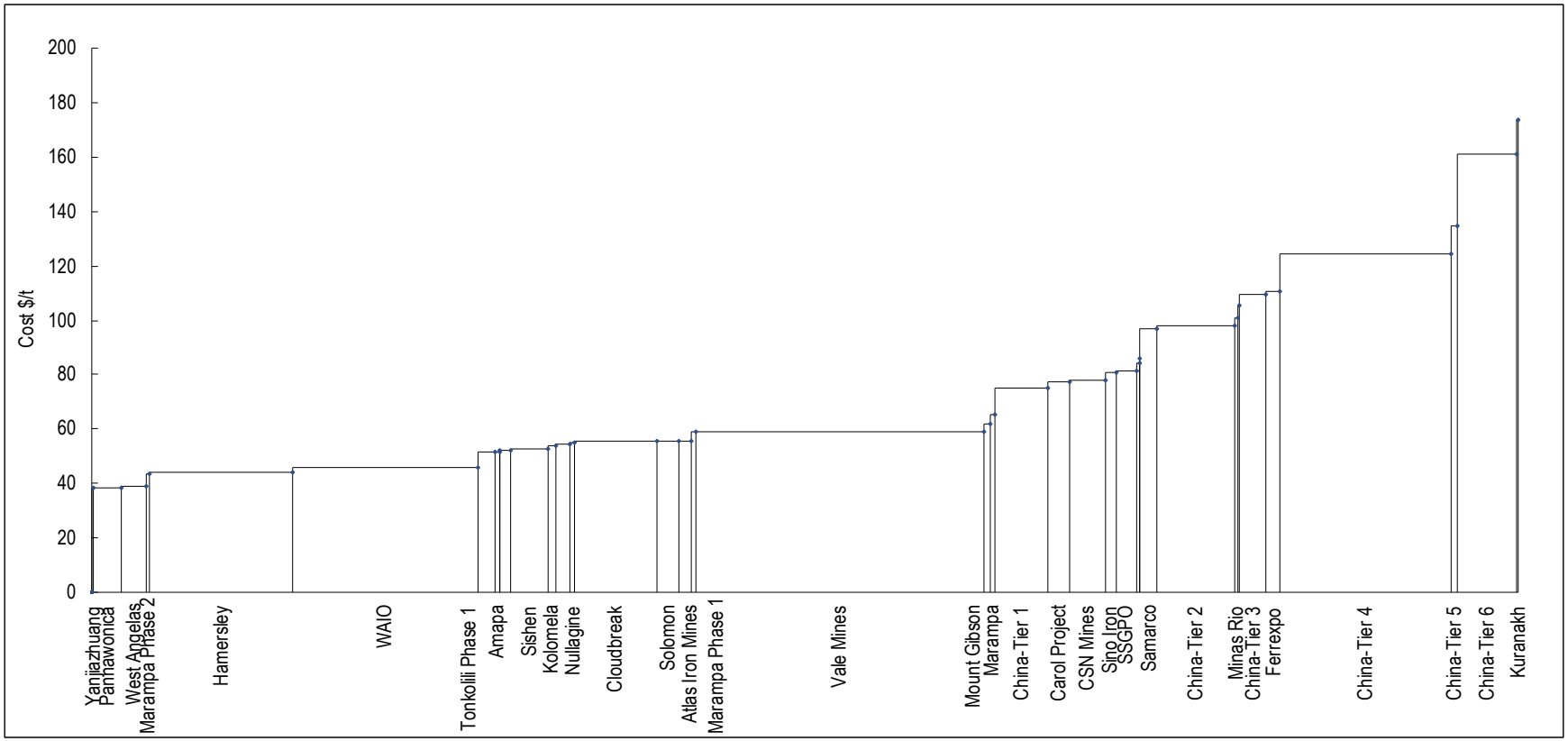
Citi analysts cover ~80% of the seaborne market and close to 90% of all new supply expected to come to market over the next 5-10 years. We have combined this data into a dynamic cost curve, which can be flexed for various exchange rates, inflation costs, labour inputs, freight rates etc. The data points to a steepening of the cost curve over the coming years. Citi calculate that the 90th percentile is around ~$105/t and is expected to rise to ~$125/t by the mid decade. The top end of the cost curve is also forecast to rise from around $135/t to $160/t.

Figure 16. Iron Ore Cost Curve CIF Over Time ($/t)



Source: Citi Investment Research and Analysis

Figure 17. Citi 2014E Iron Ore Cost Curve CIF China



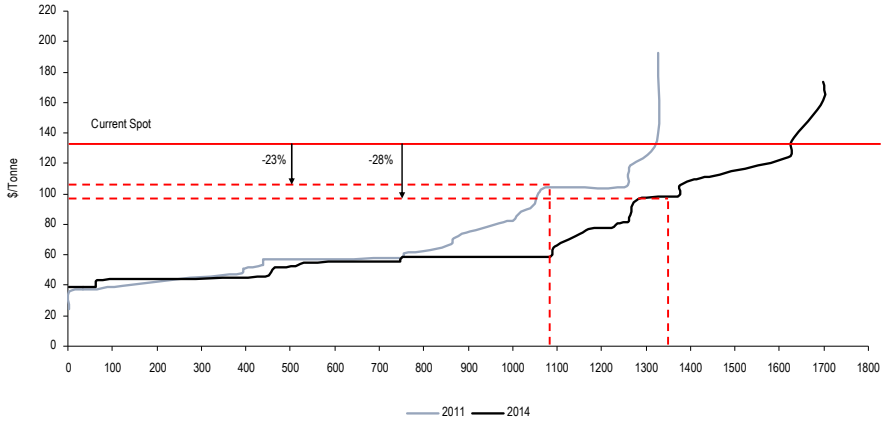
Source: Citi Investment Research and Analysis

The Million Dollar Question

When does high cost Chinese capacity get knocked out? Our analysis suggests that Chinese capacity could persist and furthermore see significant cost inflation, thus increasing the 90th percentile from $105/t to $124/t

The changing cost curve and increased production from low-cost capacity raises the million dollar question "when does the high-cost capacity get knocked out". Our cost curve analysis suggests that while there is likely to be an influx volumes into the middle of the curve over the next 3 years this is largely offset by the impact of endemic cost inflation at Chinese mines which, as Figure 18 shows, shifts previously competitive product out to the upper end effectively adding a cushioning effect. This means not only that the 90th percentile is actually set to rise from $105 to $124 but there is limited incremental downside from the shift in the cost curve. On our calculations if 20% of the high cost capacity was shut down in 2014 then the iron ore price could fall to $97/t a similar level to 2011. If we then assume the price settles at the 90th percentile then prices in both periods would fall to $78/t. This suggests upside risk to the consensual view that lower cost volumes will force a substantial flattening of the cost curve resulting in materially lower prices over the medium term.

Figure 18. Iron Ore Cost Curve CIF 2014 vs. 2011 ($/t)

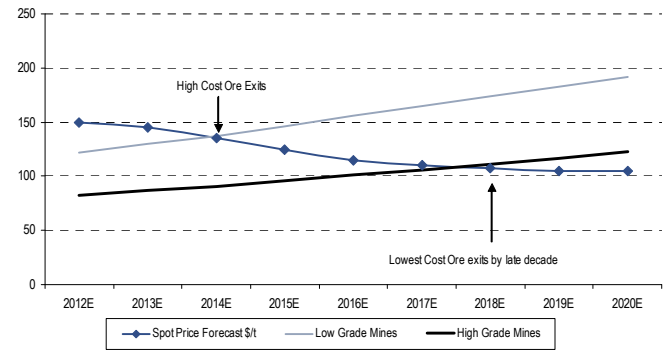


Source: WoodMackenzie, CIRA

Consensus price forecasts imply the Chinese capacity begins to decline in 2014 and is eliminated by 2017/2018. Yet for this to happen would require flat/ negative Chinese steel production growth and an optimistic supply response

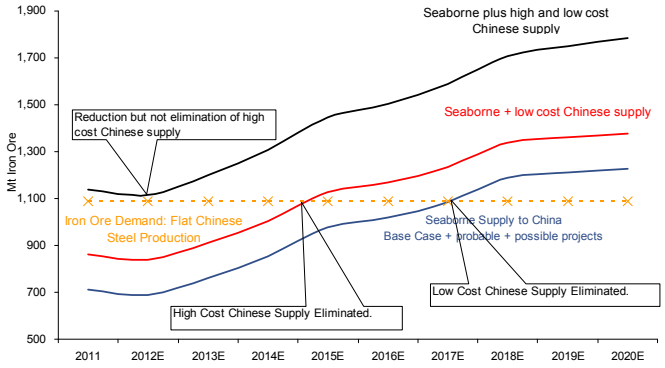
The high-cost Chinese capacity would have to be taken out for a significant correction in the iron ore price. As Figure 3 shows the forward curve is implying this will occur in 2017/2018. However, as Figure 4 shows for this to come about requires not only flat steel production in China but the addition of all probable and possible projects on an unrisked basis to our seaborne supply. It would then take to 2014 for the high-cost capacity to exit the market, with low-cost Chinese capacity exiting by late decade.

Figure 19. Chinese domestic costs vs. consensus iron ore price



Source: Citi Investment Research and Analysis

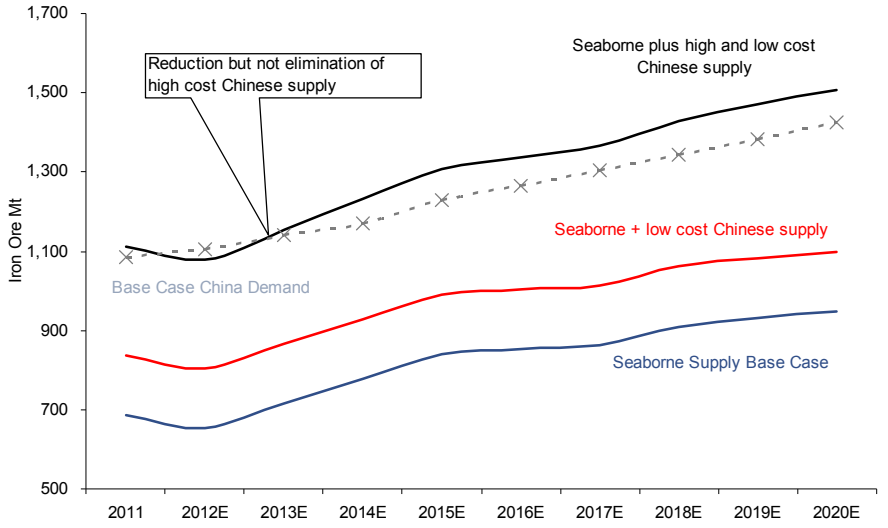
Figure 20. Consensus implied China supply/demand scenario



Source: Citi Investment Research and Analysis

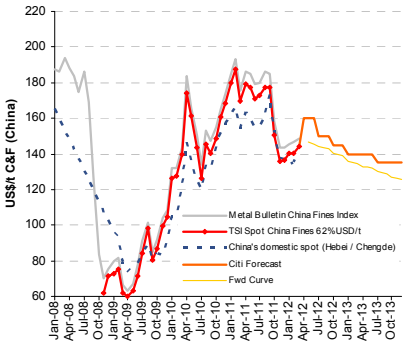
This is not the Citi base case and as a result there is a risk that our forecasts for iron ore are too bearish. As Figure 21 shows under our base case there would be a reduction in high-cost Chinese supply but no elimination.

Figure 21. Base Case Demand/Base Case Seaborne Supply



Source: Citi Investment Research and Analysis

Figure 22. Iron Ore Prices & Forecasts



Source: Citi Investment Research and Analysis

Why then have we not upped our forecasts? While we believe that the Chinese economy will continue its measured slowdown and that construction activity and fixed asset investment will be supportive of steady growth in demand for iron ore the market remains at an important juncture. Chinese steel production has recovered strongly in April but if the Chinese housing market continues to sour, steel and iron ore demand could come under further pressure later this year. As such, we believe the upgrades to our forecasts in our recent commodity quarterly (see Hyperlinks page) are adequate at this stage. As Figure 22 shows we remain above the forward curve.

Average Chinese mine cash costs are c.$120/t

Applying conservative assumptions to our cost components, we derive an iron ore cash cost for the average low-grade Chinese mine of around $120/t. We acknowledge that higher cost mines exist in the region of $140/t with Fe grades of 15-16%, however we estimate that these constitute around 10-15% of capacity and thus are a less significant support level than the c45% of volumes with cash costs of $110-120/t.

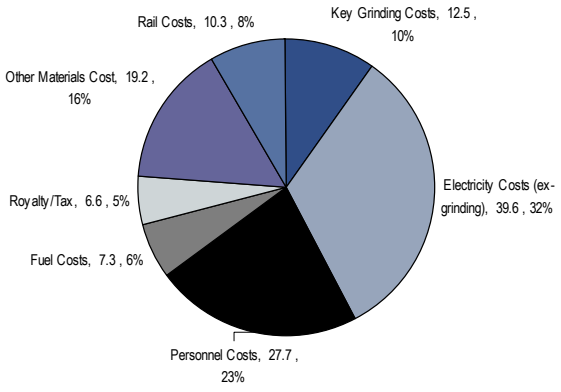
Figure 23. Chinese Domestic Iron Ore Costs – Average Low grade mine with Fe ~19%

Total Costs		2011	2012E	2013E	2014E	2015E	2016E	2017E	2018E	2019E	2020E
Key Grinding Costs	$/t	12.0	12.5	12.9	13.2	13.6	13.9	14.3	14.5	14.7	14.9
Electricity Costs (ex-grinding)	$/t	37.3	39.6	41.7	43.7	45.4	47.2	48.9	50.1	51.3	52.6
Personnel Costs	$/t	24.2	27.7	31.4	35.3	39.3	43.6	48.1	52.5	57.3	62.4
Fuel Costs	$/t	6.3	7.3	7.5	6.5	7.0	7.5	8.0	8.4	8.9	9.4
Royalty/Tax	$/t	6.4	6.6	6.8	7.0	7.1	7.2	7.2	7.2	7.2	7.2
Other Materials Cost	$/t	17.6	19.2	20.8	22.5	24.4	26.3	28.3	30.2	32.1	34.1
Rail Costs	$/t	10.0	10.3	10.5	10.8	11.0	11.3	11.6	11.9	12.2	12.5
Total Costs	**$/t**	**113.8**	**123.1**	**131.6**	**139.0**	**147.7**	**157.0**	**166.4**	**174.9**	**183.8**	**193.2**
YoY %	%		8%	7%	6%	6%	6%	6%	5%	5%	5%

Source: Citi Investment Research and Analysis

We think $120/t is a reasonable cost assumption for the bulk of lower grading mines in China, though higher cost mines do exist. The greatest cost components are electricity and personnel

Figure 24. Cash cost breakdown of Chinese domestic iron ore production at $119/t



Source: Citi Investment Research and Analysis

Our estimates are based on a series of key operational inputs we believe are relatively common to the mining and processing of low grade iron ore in China. These inputs are outlined below.

Figure 25. Iron Ore Cost Function – Key Inputs

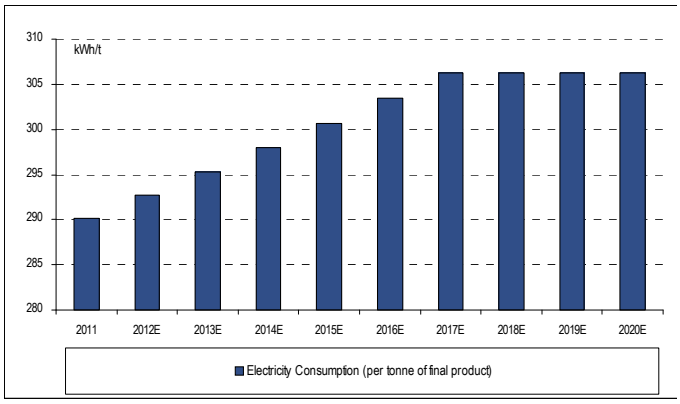
Price Inputs		2011	2012E	2013E	2014E	2015E	2016E	2017E	2018E	2019E	2020E
Electricity	Rmb/kWh	0.97	0.99	1.02	1.04	1.07	1.10	1.12	1.15	1.18	1.21
Electricity	$/kWh	0.15	0.16	0.16	0.17	0.18	0.18	0.19	0.19	0.20	0.20
Grinding Steel ($50-100 premium to benchmarks)	$/t	800	800	800	800	800	800	800	800	800	800
Oil (Brent)	$/bbl	110	124	120	91	93	95	98	100	103	105
Diesel Price	$/KG	1.19	1.29	1.26	1.03	1.05	1.07	1.09	1.11	1.13	1.15
USD/RMD rate	X	6.46	6.30	6.18	6.10	6.07	6.04	6.04	6.04	6.04	6.04
Monthly Miner's Wage	Rmb	3,700	3,885	4,079	4,283	4,497	4,722	4,958	5,206	5,467	5,740
Monthly Miner's Wage	US$	572	617	660	702	741	782	821	862	905	950
Annual Wage	US$	6,869	7,405	7,918	8,425	8,891	9,382	9,851	10,344	10,861	11,404
Rail Freight	$/t	10	10	11	11	11	11	12	12	12	12
Resource tax	Rmb/t Ore processed	10	10	10	10	10	10	10	10	10	10
Resource Inputs		**2011**	**2012E**	**2013E**	**2014E**	**2015E**	**2016E**	**2017E**	**2018E**	**2019E**	**2020E**
Head grade Fe%	%	19%	19%	19%	19%	18%	18%	18%	18%	18%	18%
Final grade Fe%	%	63%	63%	63%	63%	63%	63%	63%	63%	63%	63%
Metallurgical Recovery %	%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%
Strip Ratio	(Waste/Ore)	0.70	0.79	0.88	0.97	1.06	1.14	1.23	1.32	1.41	1.50
Resource Outputs		**2011**	**2012E**	**2013E**	**2014E**	**2015E**	**2016E**	**2017E**	**2018E**	**2019E**	**2020E**
Ore Mined/Processed (per tonne of final product)	tonne	4.1	4.2	4.2	4.3	4.3	4.3	4.4	4.4	4.4	4.38
Mass Yield	%	24%	24%	24%	23%	23%	23%	23%	23%	23%	23%
Waste material (per tonne of final product)	tonne	2.9	3.3	3.7	4.1	4.5	5.0	5.4	5.8	6.2	6.6
Earth Moved	tonne	7.05	7.48	7.92	8.37	8.83	9.30	9.77	10.16	10.55	10.94
Operational Inputs		**2011**	**2012E**	**2013E**	**2014E**	**2015E**	**2016E**	**2017E**	**2018E**	**2019E**	**2020E**
Typical Work Index	(kWh/t)	10	10	10	10	10	10	10	10	10	10
Labour productivity (tonnes of earth moved per employee)	tonnes per annum	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Electricity required per tonne of ore processed (ex-grinding)	kWh/t	60	60	60	60	60	60	60	60	60	60
Fuel required per tonne of earth moved (Kg of diesel fuel)	Kg/t	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Grinding Bodies required per tonne ore processed	Kg/t	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75

Source: Citi Investment Research and Analysis

The notable inputs here are:

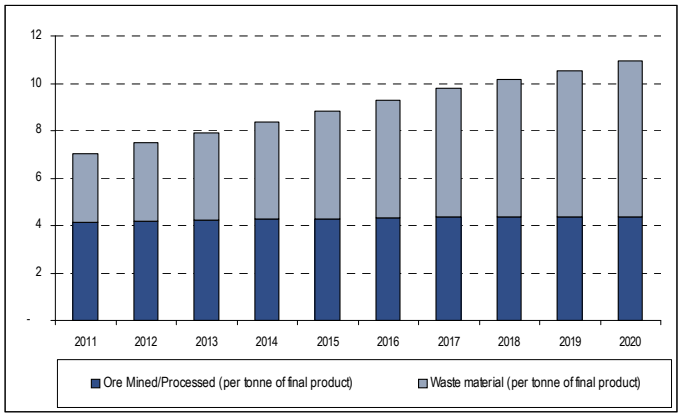
Low ore grades of 19%, declining to 18% by 2020 – This implies over 4 tonnes of ore processed per one tonne of final 62% product, a mass yield of 25%. Higher processed volumes entails higher electricity, personnel, fuel, consumables (eg steel grinding bodies) costs.

Figure 26. Electricity Consumption per tonne of final product



Source: Citi Investment Research and Analysis

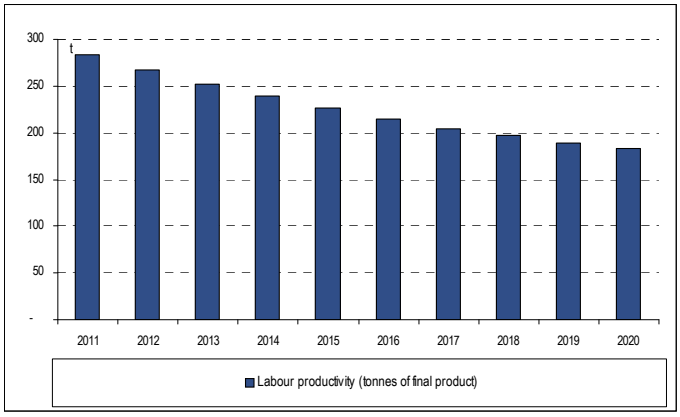
Figure 27. Earth moved per tonne of final product



Source: Citi Investment Research and Analysis

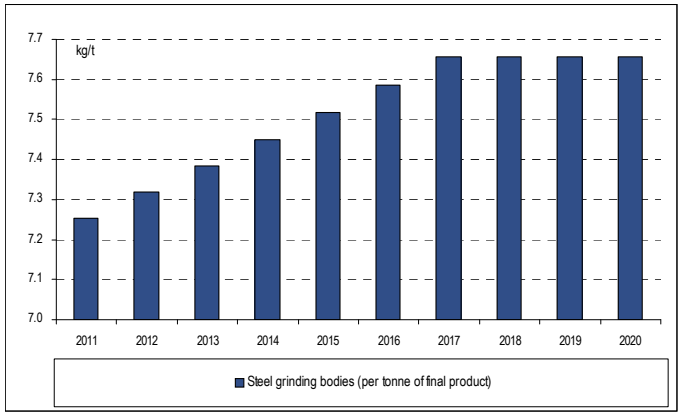
Strip ratio of 0.7 - means that in total 7 tonnes of material (ore and waste) need to be mined per one tonne of final product. This increases personnel and fuel costs.

Figure 28. Labour productivity (tonnes of final product)



Source: Citi Investment Research and Analysis

Figure 29. Steel Grinding bodies required Kg/t of final product



Source: Citi Investment Research and Analysis

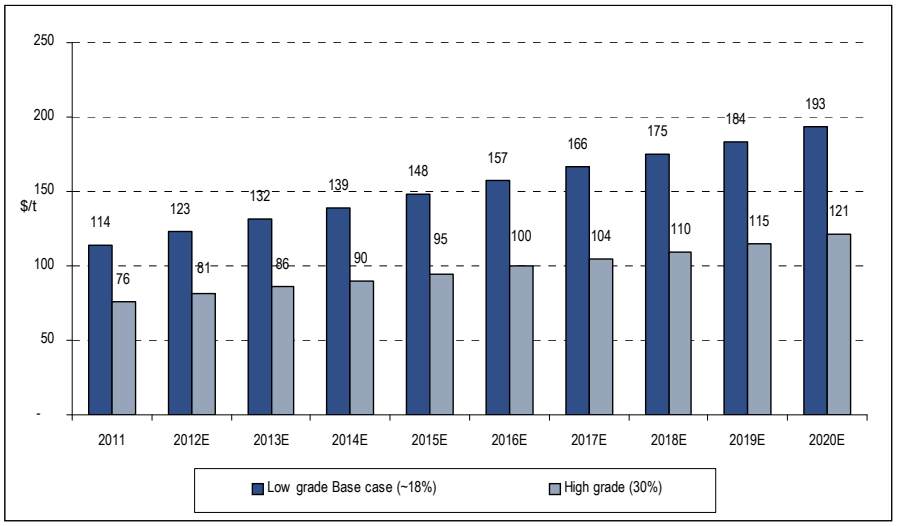
Labour productivity – We also assume labour productivity is well below that of listed international peers, the reasoning being that many Chinese iron ore mines are small-scale enterprises of 0.5-1mt and hence lack economies of scale and will generally be less mechanized. We base our labour productivity assumptions on tonnes of earth moved to flex our model for the increasing volumes of waste and ore required as iron ore grades decrease and strip ratios increase.

Lower End Costs Around $70-80/t

The majority of Chinese iron ore resources (we estimate around 80-85%) range from 30% Fe content to 18%. Therefore it is also appropriate to highlight the lower end cost of production which is likely to be achieved at the higher grade mines. The chart below highlights the range in costs we see each year between the high grade and low grade mines.

We think the low end of Chinese iron ore production costs is in the $70-80 range. This would be a higher grade mine with a ~30% Fe resource and potentially lower electricity tariffs and greater economies of scale.

Figure 30. Cost range of domestic iron ore production – high grade and low grade mines



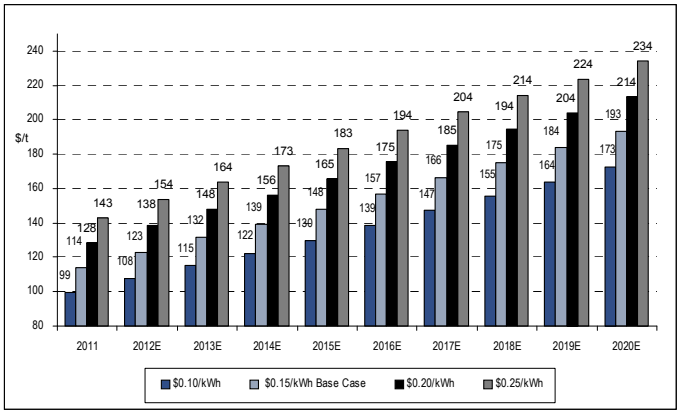
Source: Citi Investment Research and Analysis

It is possible some mines may be lower than this level, aided by higher Fe content, lower power tariffs, greater mechanization and labour productivity. However, we believe $70-80/t constitutes the key support level for higher grade Chinese iron ore mines. We estimate around 20% of volumes are in the 26-34% Fe content range i.e. relatively high grade for China.

Important to acknowledge the distribution of costs

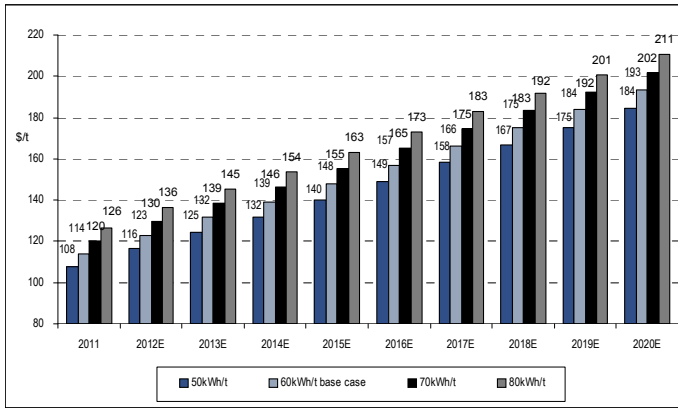
Iron ore mines are sensitive to a whole range of parameters, which can have a significant impact on costs. The charts below display our model's sensitivities to key inputs:

Figure 31. Sensitivity to Electricity Prices ($/kWh)



Source: Citi Investment Research and Analysis

Figure 32.Sensitivity to Electricity consumption/tonne ore processed

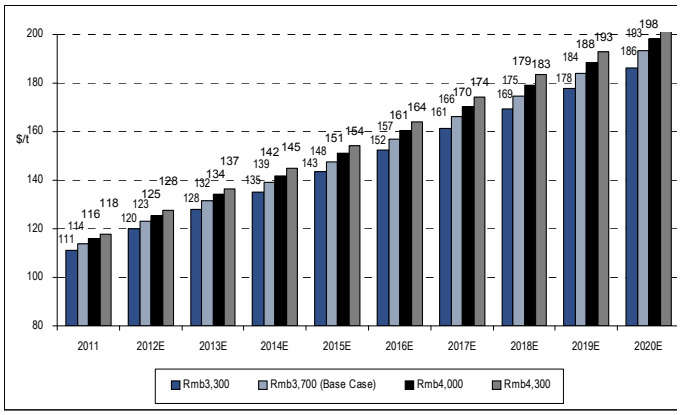


Source: Citi Investment Research and Analysis

Electricity constitutes over 30% of our current cost estimate

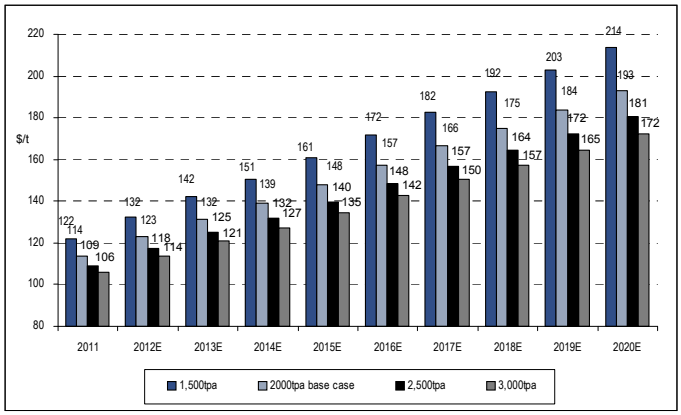
As Figure 31 and Figure 32 highlight, electricity is one of the key determinants of operating cost – both the electricity tariff paid by the mine and the amount of electricity consumed per tonne of ore passed through the processing circuit, are key considerations. Electricity constitutes ~30% of our base case cost assumption.

Figure 33. Sensitivity to wages Rmb/month



Source: Citi Investment Research and Analysis

Figure 34. Sensitivity to labour productivity (tonnes of earth moved)



Source: Citi Investment Research and Analysis

Labour costs are the second highest component of our cost estimate

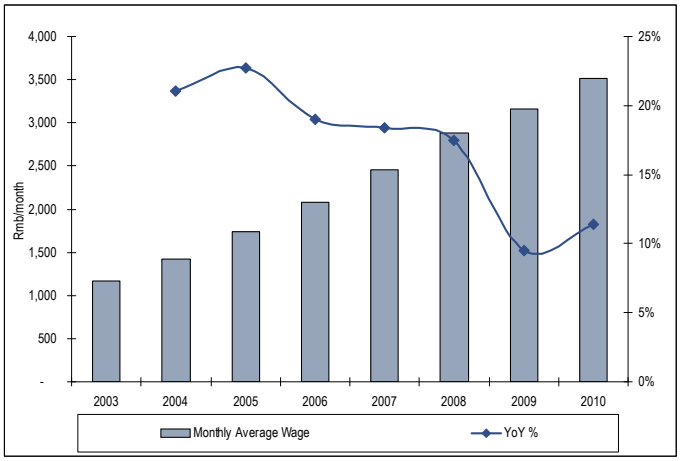
Labour is also a key consideration and accounts for 23% of our operating costs. Therefore, the sensitivity to wage inflation will become an increasingly prominent theme, with the double impact of decreasing labour productivity (hence more workers required) as grades decline and greater volumes are required.

Personnel could be the main cost pressure

If wage pressures continue in the Chinese mining sector, personnel costs could become the main component of cash costs, overtaking electricity

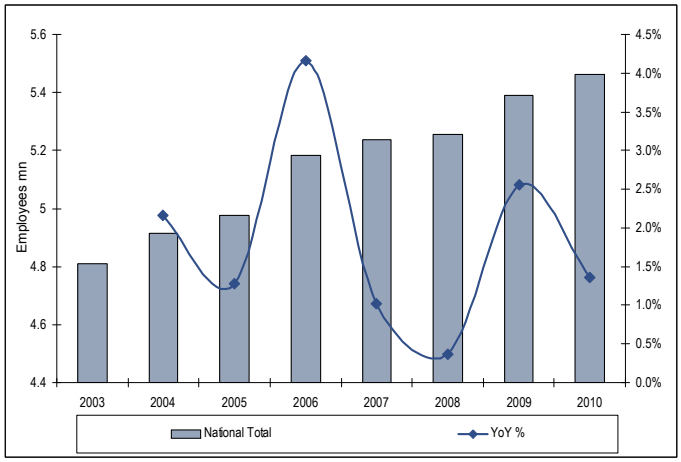
Personnel costs already form a significant chunk of our estimates, second only to electricity costs. However, based on the historical wage inflation in the Chinese mining sector and with increasing labour requirements per tonne of final product (as Fe content declines), we foresee a situation where personnel expenditure becomes the main cost component of domestic iron ore production. We expect personnel costs to overtake electricity costs as the main component in 2017/2018, constituting 30% of cash costs.

Figure 35. Chinese Average monthly wage for a miner (Rmb)



Source: Citi Investment Research and Analysis

Figure 36. Number of employees in mining

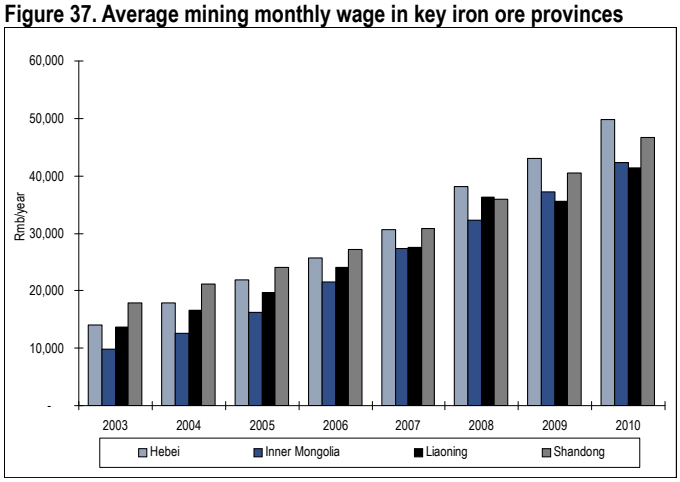


Source: Citi Investment Research and Analysis

Chinese wage growth has been running at 17% CAGR since 2003

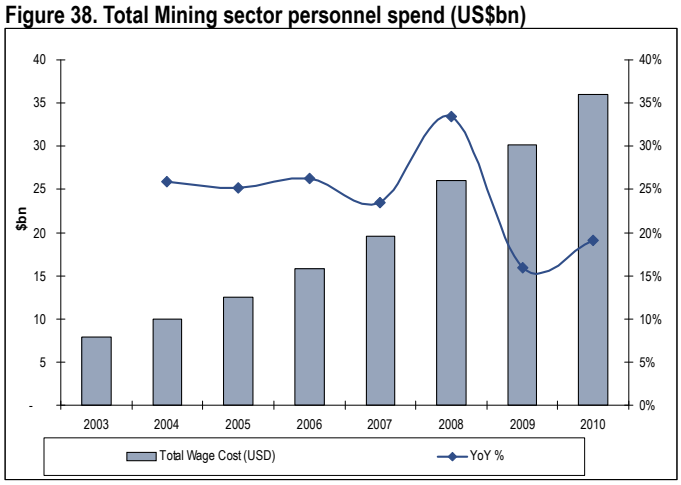
Chinese wage growth has been running at 17% CAGR since 2003, taking the average annual wage from Rmb14,073 to over Rmb42,000. The average annual wage from the key iron ore mining provinces – Hebei, Inner Mongolia, Liaoning and Shandong – has increased at 18% CAGR (Figure 37).

Figure 37. Average mining monthly wage in key iron ore provinces



Source: Citi Investment Research and Analysis

Figure 38. Total Mining sector personnel spend (US$bn)



Source: Citi Investment Research and Analysis

What does this tell us?

Costs are supportive to prices, but there is downside

Our analysis suggests a small number of mines are running at costs of $140/t, with a firmer support level at $120/t. Costs are therefore generally supportive to current prices but downside does exist.

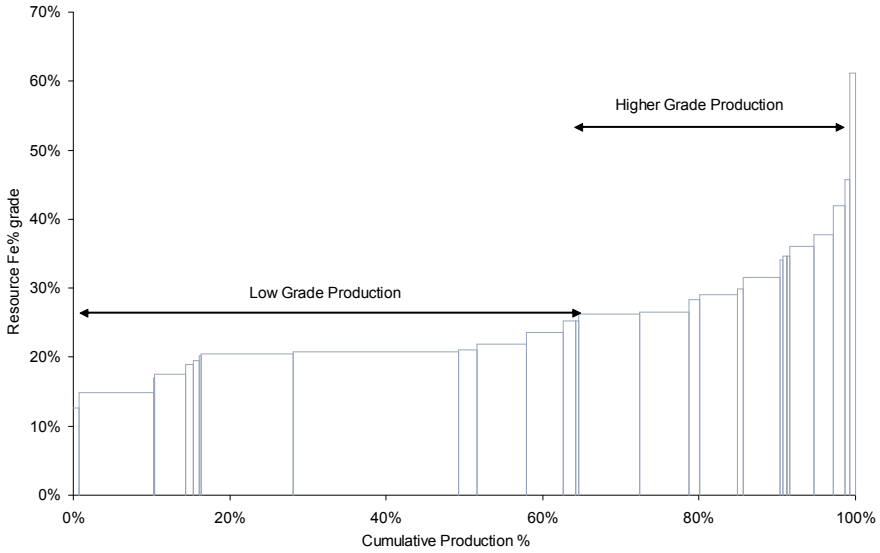
There has been a view emerging that the reason for Iron Ore's pricing stability in 2012 is due to the escalation in Chinese costs of producing domestic ore to the current pricing level, i.e, price is now equal to marginal cost. We would acknowledge that costs at some mines are in the $140-150/t range, but we believe these make up around 10-15% of domestic capacity at most. We think a firmer support level is around the $120/t level, where we estimate around 45% of volumes to be placed.

Chinese supply will not disappear overnight

We estimate that around 65% of Chinese domestic production is from low grading, higher cost mines

The reason for highlighting our estimated pricing range between low Fe content mines and higher grading mines, is to demonstrate that it will not simply be a case of 'here one day, gone the next' for Chinese domestic production. Even if demand and supply dynamics reduce and eventually remove the need for China to act as the swing producer in iron ore, the range in production costs in China mean that will be a phased withdrawal with a number of price support levels passed along the way.

Figure 39. Fe % grade distribution of Chinese Domestic production

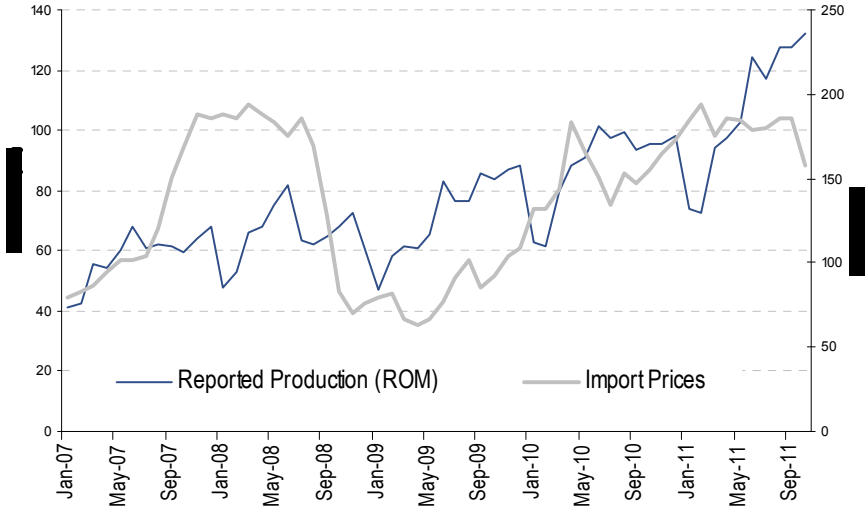


Source: Citi Investment Research and Analysis

When will Chinese production exit the market?

We believe that Chinese domestic production will remain price sensitive, and we have historically seen a strong correlation between import prices and RoM production.

Figure 40. Chinese Production - Price Elastic

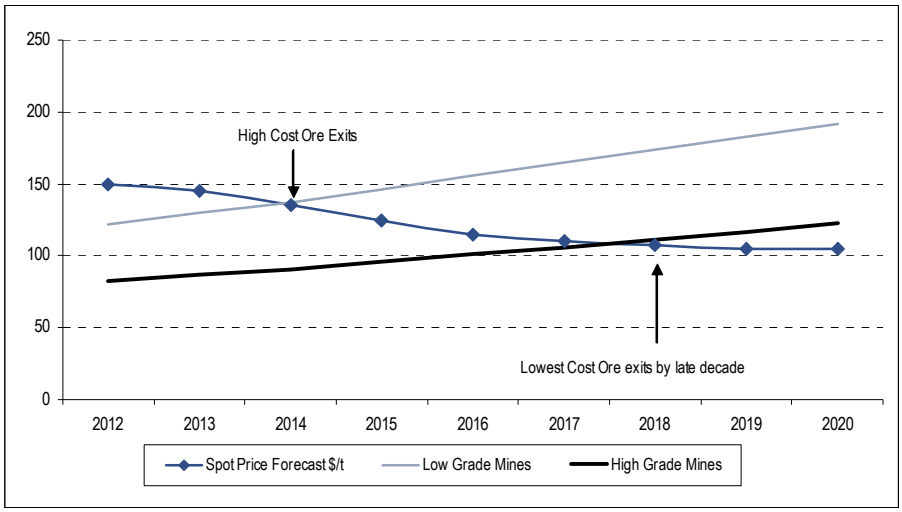


Source: Citi Investment Research and Analysis

Taking consensus iron ore price forecasts and charting against our Chinese production cost estimates implies high-cost Chinese capacity would become uneconomical and start to exit the market in 2014, with low-cost Chinese capacity exiting the market by late decade.

Consensus iron ore price forecasts and Citi's Chinese cost estimates would imply the exit of high-cost Chinese iron ore in 2014, with the lower-cost capacity exiting towards the end of the decade. Figure 42 charts the implied supply demand/scenario from consensus forecasts…

Figure 41. Chinese domestic costs vs. consensus iron ore price

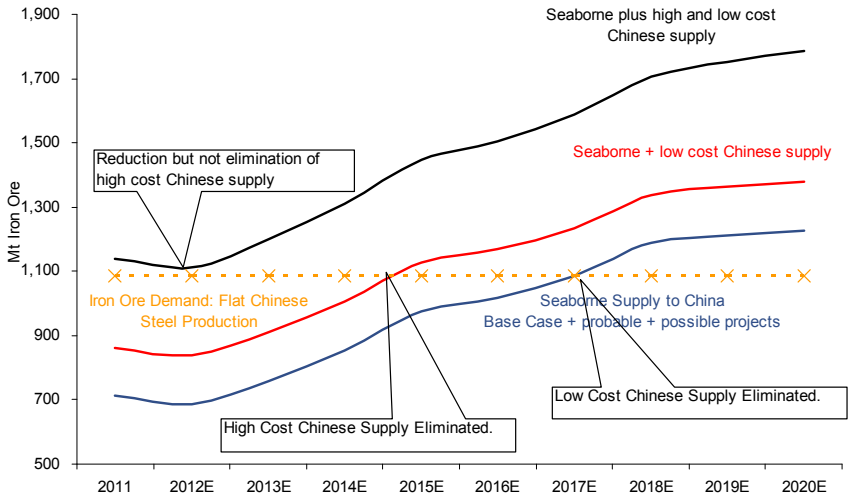


Source: Bloomberg, Citi Investment Research and Analysis

For this to materialize would require either an influx of new supply pushing down market prices and/or a flat to negative demand outlook. We estimate we would have to see all possible new iron ore projects delivered, plus declining Chinese steel production of around 2% per annum, for the above scenario to take place.

We think consensus price forecasts are potentially implying zero Chinese steel production growth and optimistic expectations of supply side project delivery. The key assumptions: 1) The blue supply line indicates all the seaborne supply available for Chinese consumption after excluding exports to other major consumers (e.g. Japan), 2) The red line adds low-cost Chinese supply to the blue line, 3) The black line adds high-cost Chinese supply to the red line, 4) When the flat demand line crosses these supply lines, capacity will begin to exit the market; high-cost Chinese supply first, followed by low-cost Chinese supply and then seaborne supply

Figure 42. Consensus implied Chinese supply/demand scenario

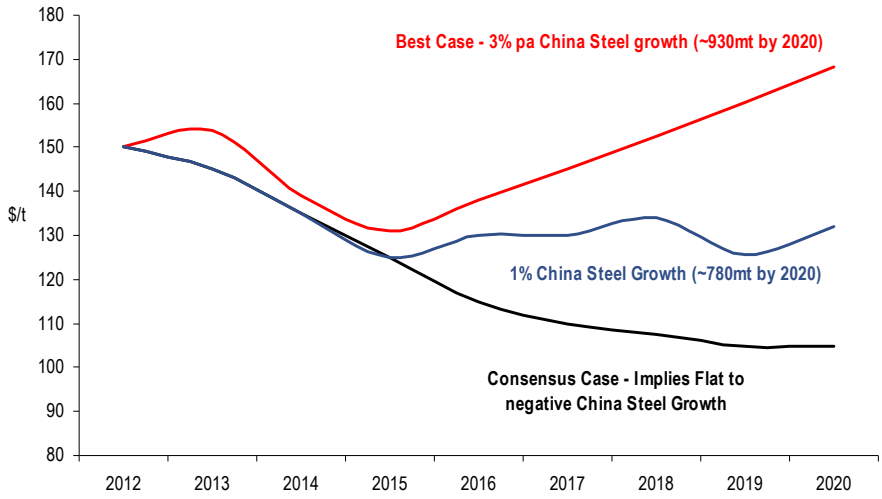


Source: Citi Investment Research and Analysis

Supply/Demand Scenarios

The chart shows the potential price implications from varying supply demand scenarios. Our best case is based on Chinese Steel growth of 3% per annum, while the worst case – which consensus price forecasts imply – assumes zero/ negative Chinese steel production growth

Figure 43. Potential price scenarios



Source: Citi Investment Research and Analysis

The market could be much tighter than consensus expects

Our base case supply and demand forecasts suggest that the market will maintain its dependence on high cost Chinese domestic capacity. Even under a flat demand scenario the market is reliant upon high cost Chinese capacity until late in the decade

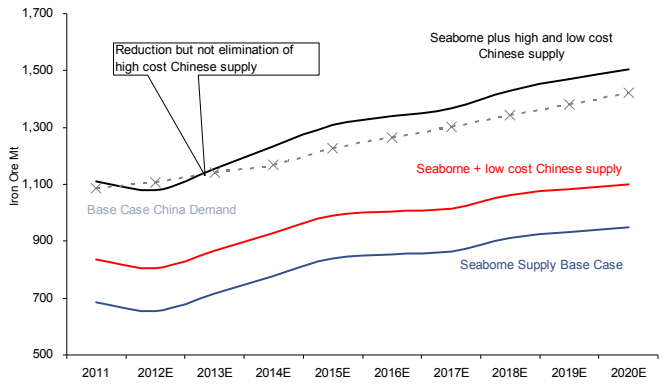
Our seaborne supply growth forecast is composed of projects we consider to be base case, probable and possible. We weight base case projects at 100%, probable at 60% and possible at 0%. Our base case demand and supply forecasts imply continued dependence on high cost Chinese capacity for the remainder of the decade. Even on the assumption of 0% steel production growth in China from here onwards, the high cost capacity in China is only eliminated at the end of the decade, with lower cost Chinese capacity continuing to operate.

The Charts explained

The following scenario charts are based on the following key assumptions:

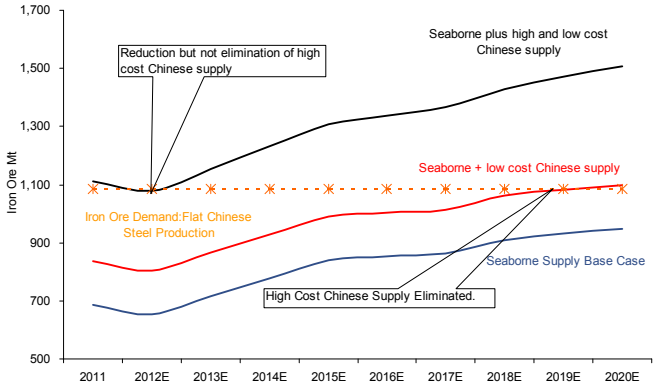
- Chinese domestic iron ore capacity is the swing producer in the market.
- The blue supply line (the lowest line): Seaborne supply available to China after exports to other major consumers such as Japan. We vary seaborne supply by including probably and possible projects not fully included in our base case.
- The red supply line (the middle line): Seaborne supply plus the low-cost Chinese capacity.
- The black supply line (the top line): Seaborne supply plus low-cost Chinese capacity plus high-cost Chinese capacity.
- The dashed demand line: Iron ore demand based on either our base case steel production forecast or flat steel production from here onwards.

Figure 44. Base Case Demand/Base Case Seaborne Supply



Source: Citi Investment Research and Analysis

Figure 45. Flat Demand/Base Case Seaborne Supply

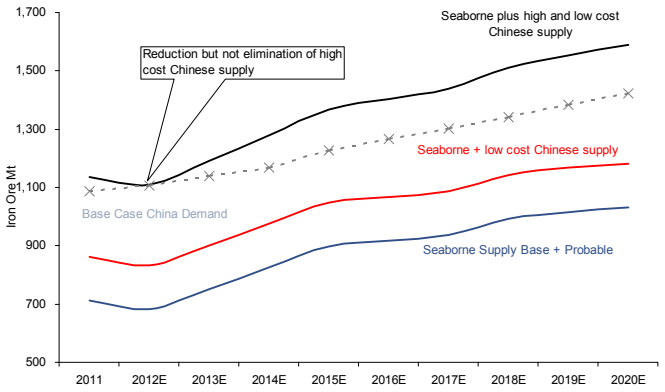


Source: Citi Investment Research and Analysis

The outcome is little changed if we include all 'probable' projects at 100% into our seaborne supply

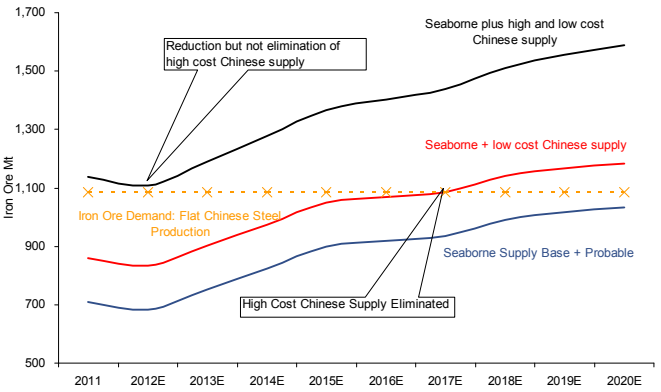
If we increase the weighting on all of our probable projects to 100% and run our base case and flat demand scenarios the result is largely the same, although on a flat steel production assumption high cost Chinese capacity would be eliminated a few years sooner due to greater seaborne supply from probable projects.

Figure 46. Base Case Demand/Base Case + Probable Supply



Source: Citi Investment Research and Analysis

Figure 47. Flat Demand/Base Case + Probable Supply



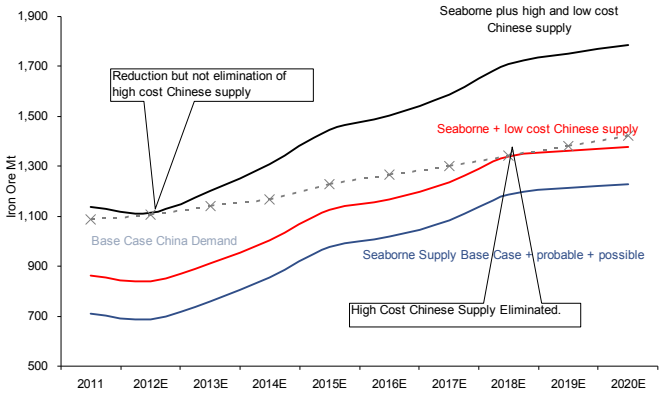
Source: Citi Investment Research and Analysis

When is it time to worry?

Start to worry if all probable and possible projects are delivered successfully along with flat Chinese steel production from here onwards

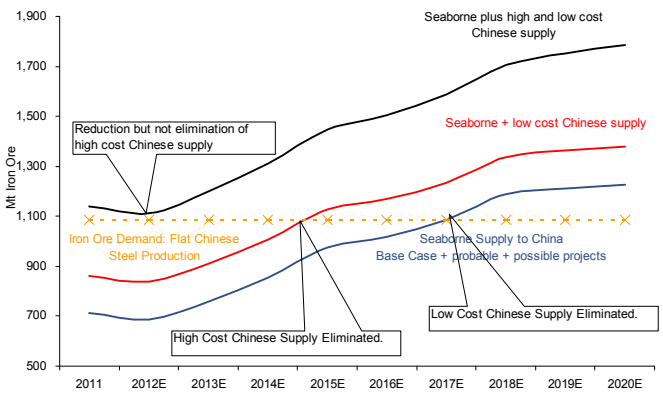
If all probable and possible projects come to fruition i.e. all major West African projects which require major capital investments and the construction of large railways and pipelines succeed in doing so and then Chinese steel production remains flat on 2012, this is when we should start to worry; high-cost Chinese capacity would be eliminated in the next few years, with low-cost Chinese capacity eliminated by 2017, followed by a surplus in seaborne supply.

Figure 48. Base Case Demand/Base Case, Probable + Possible Supply



Source: Citi Investment Research and Analysis

Figure 49. Flat Demand/Base Case, Probable + Possible Supply



Source: Citi Investment Research and Analysis

Push, Demand Pull…or Value in Use?

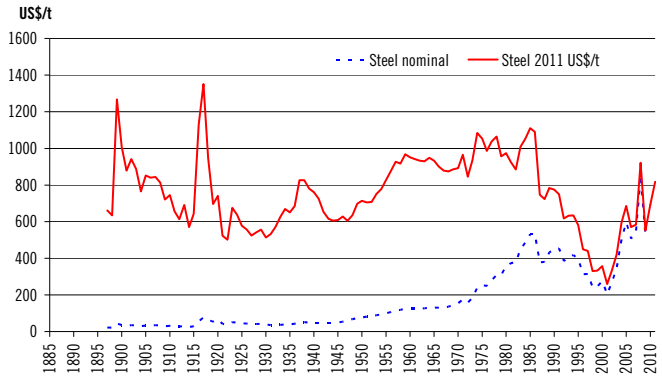
A critical problem in just basing the iron ore price purely on the cost curve is the fact that it doesn't take into account demand. Historically, there has been a strong argument that raw material costs are a direct pass through for the steel producers, we however, would argue this no longer applies. The cost pass through arguably only works under a scenario of annual price negotiations and/or high utilisation rates, as these conditions no longer exist and both the steel and iron ore markets have evolved to 'real time' and spot markets we think this dynamic has changed.

Basing demand forecasts on consumption per capita (kg per person trends) omits a key component: The price of the underlying commodity

In constructing a demand outcome we have turned to a value in use analysis rather than just purely based on intensity of use. The structural bull thesis for the super cycle is largely predicated on consumption per capita (kg per person) and then extrapolating this into the future. Arguably this analysis avoids one critical component, which is the price of the underlying commodity. It assumes that a developing economy will continue to increase commodity consumption regardless of the underlying price. In our opinion, the iron ore price itself can result in demand destruction, or certainly affect marginal consumption.

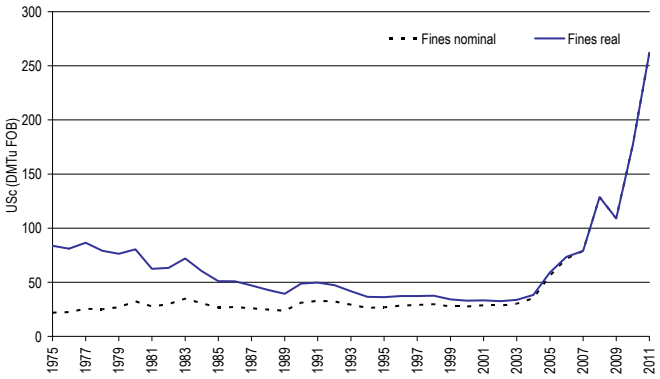
As the below charts show the iron ore price has significantly outperformed the steel price resulting in margin compression for the steel producers, contradicting an old argument of steel producers being able to pass through higher input costs. We expect that value in use and the quality of products will be a larger driving factor going forward.

Figure 50. Steel Prices Over Time ($/t)



Source: Citi Investment Research and Analysis

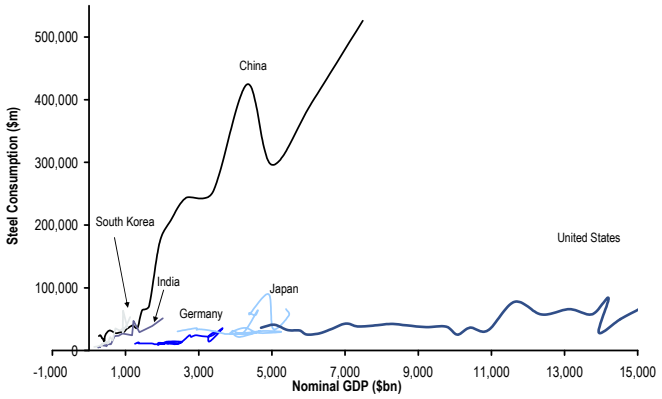
Figure 51. Iron Ore Prices Over Time USc/DMTU



Source: Citi Investment Research and Analysis

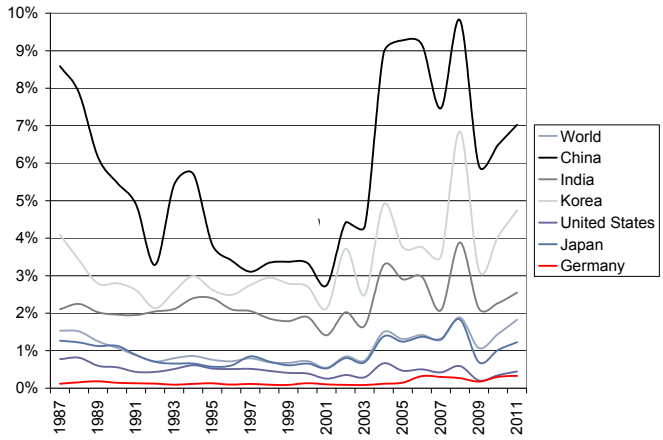
Taking into account the price of steel, rather than just looking at a kg/capital number, suggests that China has already overtaken most of the developed world on a value in use basis, the "Sleeping Dragon" is spending an equivalent of 7% of its GDP on steel consumption; the peak of this consumption occurred in 2008 and is likely to result in a falling intensity of use. Although the base effect of higher production should still correspond to incremental consumption growth.

Figure 52. Steel consumption $m against nominal GDP



Source: Citi Investment Research and Analysis

Figure 53. Steel consumption as a % of GDP



Source: Citi Investment Research and Analysis

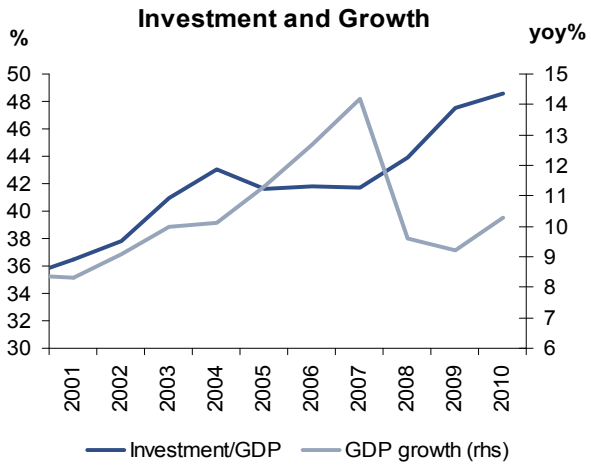
China is already becoming less efficient due to higher input costs

China is already becoming less efficient due to higher input costs. In the past decade, China's GDP grew at an average rate of 10.5%. Investment expanded at an average rate of 13.5% during the period and was the main contributor of growth. As a result, share of investment in GDP increased from 36.5% in 2001 to 48.5% in 2010.

The efficiency of investment appears to be falling – In the absence of a more reliable metric for assessing the productivity of investment, we employ the Incremental Capital Output Ratio (ICOR) as an indicator of marginal product of investment. During 2001-10, China's average ICOR topped 4. More recently, the ratio rose to around 5, with a big jump in investment/GDP ratio – associated with stimulus measures introduced to tackle the global financial crisis – producing a relatively small output response.

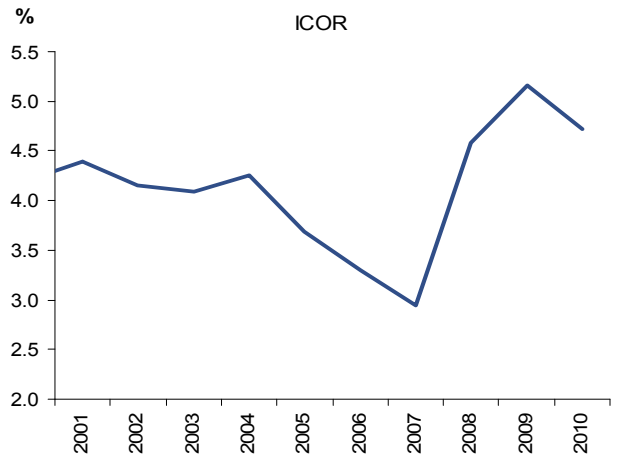
We therefore believe that value in use is going to be a bigger driver going forward.

Figure 54. Investment produced weaker output response recently…



Source: Citi Investment Research and Analysis

Figure 55. … indicating lower marginal product of investment.



Source: Citi Investment Research and Analysis

Value in Use - of increasing relevance

We expect Chinese mills to optimise their operations through a focus on value in use. This structural trend is likely to benefit those miners producing the highest quality iron ore.

Given iron ore cost pressures are set to remain and underpin pricing through to mid-decade at least, we believe that global steel mills are likely to be restricted in their ability to pay higher iron ore prices due to squeezed margins, the question is what are the options? We think that under this scenario the Chinese, in particular, would resort to optimising their operations and focusing on quality of product. At this juncture the 'value in use' argument comes into play, which bodes well for those iron ore miners producing the best quality iron ore products and not so well for those that currently benefit from strong pricing but actually sell an inferior product.

Steel profitability suppressed

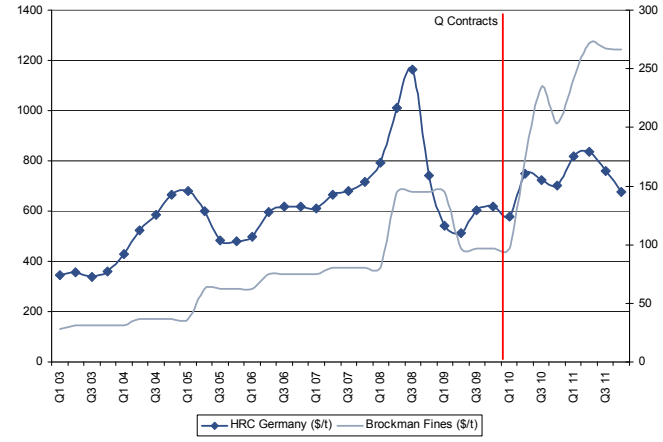
Steel margins expanded from 10% in 2003 to 20-25% in 2005-08 on the back of annually negotiated input costs and a steel price advancing with the advent of the super cycle

The advent of quarterly contracts in iron ore in April 2010 initiated a structural shift not just in pricing but in the business model of the steel industry. Prior to this, steel producers were able to lock in the price of iron ore in annual contracts and participate in any margin expansion on the back of increasing steel prices (Figure 56). This structure with sales at spot and costs up to one year lagging enabled the industry to more than double EBITDA margins from 10% in 2003 to 20-25% in the 2005-08 as China kick-started the super cycle (Figure 57).

Quarterly contracts destroyed that business model curtailing pricing power and compressing margins which remain >10pps below pre-crisis levels

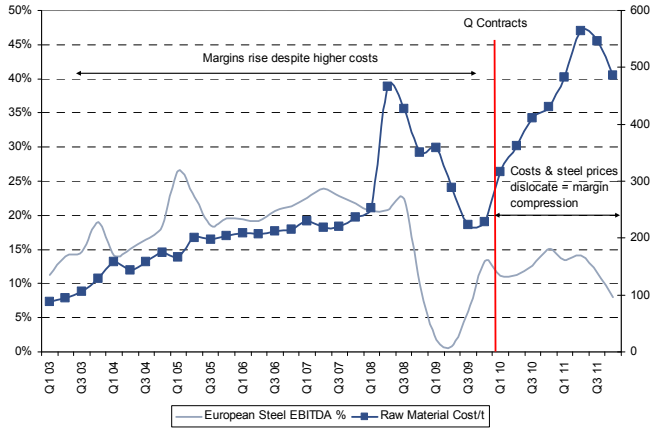
Through a confluence of mark-to-market costs, increased transparency throughout the value chain and struggling utilisation rates (Figure 58) the pricing power of the steel producers has effectively been curtailed. This has transformed the industry dynamic into a cost-plus pricing model reflected in the inability of margins to recover to pre-crisis levels.

Figure 56. Steel Companies Rode The Chinese Steel Contango



Source: Citi Investment Research and Analysis

Figure 57. Profitability Has Been Suppressed

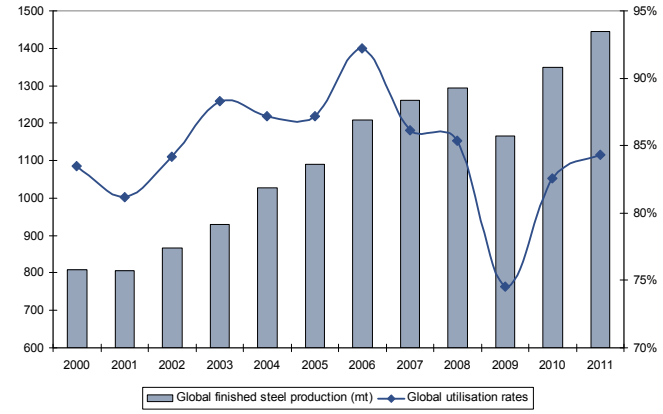


Source: Citi Investment Research and Analysis

There is limited scope now for steel prices to rise with the Chinese spending 7% of their GDP on steel in 2011

However, this cost-plus model is asymmetric. While consumers demand lower prices if inputs decline there is limited capacity to accept higher prices if inputs rise. As Figure 53 highlights, China is now spending 7% of its GDP on steel. While this is down some 3pps from 2008 the sustainability of this level is questionable given its scale relative to other nations. Therefore, while the kg intensity of consumption may still rise the offsetting impact is likely to be limited upside to prices.

Figure 58. Utilisation Remains Below Levels Conferring Pricing Power



Source: Citi Investment Research and Analysis

Figure 59. EBITDA: Iron Ore vs. European and Chinese Steel Producers

Source: Citi Investment Research and Analysis

Iron ore margins have expanded to a record of 70% while Chinese steel producers in particular have faced continued pressure with margins falling as low as 7% in 2011, 5pps below European mills

This disconnect between pricing potential and underlying commodity exposures has compressed margins at Chinese mills to a greater extent than their European counterparts. While EBITDA margins at European mills have recovered 5pps over the lows of 2009 Chinese producers have continued to weaken with margins setting a new low in 2011. Iron ore producers continue to make hay with margins a record 70% last year (Figure 59).

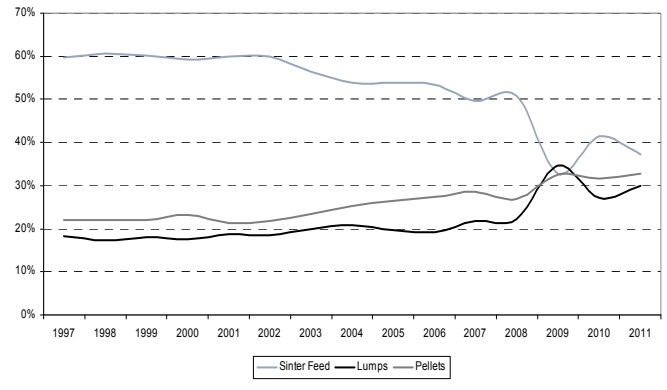
A key factor in lower Chinese steel margins is lower grade iron ore

A contributing factor to this underperformance, in our view, is the low quality of iron ore feedstock used in Chinese mills compared to the US and Europe.

Demand for quality iron ore, reflected in the 63-58% Fe has been driven by Western steel mills indicating the relatively low grade of Chinese feed stock

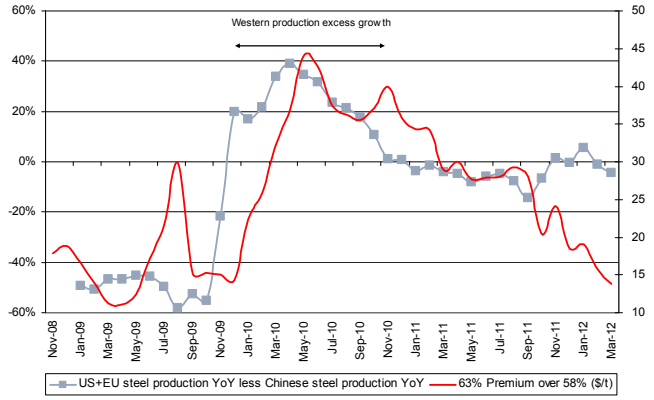
While sinter feed (concentrate and fines) as a share of global production has increased from 65% in 2000 to 70% in 2011 this has been largely driven out of China. Ex-China steel mills have switched to higher grade feed in pursuit of cost savings with lump and pellet now accounting for c.60% of demand from c.40% in 2003 (Figure 60). This is reflected in the 'premium for quality' (spread between 63% Fe grade ore and 58%) shown in Figure 61 which appears to be driven by excess growth from Western steel manufacturers over Chinese producers. This suggests not only that feedstock in China remains relatively low grade but as mills switch into premium product the quality differential in iron ore could be sustained at a higher level for longer.

Figure 60. Global Demand By Product (Ex-China)



Source: CRU, CIRA

Figure 61. Western Demand Drives The Premium Grade Excess



Source: Bloomberg, CIRA

The benefits to a steel producer of switching to products with higher value include:

- Short-term: Increased throughput. Higher Fe content increases the effective production immediately.
- Long-term: Reliable supply of higher quality products allows mills to reconfigure the blast furnace reducing energy consumption, pollution and raw material inputs while allowing for increased product output quality.

The tangible benefits to upgrading input feed come through reduced coking coal costs and productivity gains. This benefit is reflected in the excess of the 63-58% spread over the simple differential of the iron content

This is also reflected in Figure 61 where even in periods of weak demand the premium spread has remained above the equivalent Fe% content differential. For example in May 2009 the spread was $12, $8 in excess of the simple Fe% difference. This implies consumers gain additional savings through the use of the higher grade ore.

Given the benefits to switching we expect Chinese mills to look to optimise their choice of inputs in the future benefits those producers of high grade products

Given these cost advantages we would expect the Chinese to become more discerning in their choice of inputs as they attempt to defend margins in the face of a challenging pricing environment. Up until now inferior products have piggybacked on the super cycle achieving prices unwarranted by their value in use. As Chinese mills become more discriminating, we expect this to result in demand for higher quality products including lump, premium concentrate and pellets growing in excess of low grade feed and the companies that produce them outperforming.

Supply – volume growth

As highlighted in the previous section, seaborne supply is likely to be a critical factor in balancing out the high-cost production. To date, supply in the seaborne market has lagged expectations mainly out of the key regions of Brazil and India. Going forward our regional analysts expect:

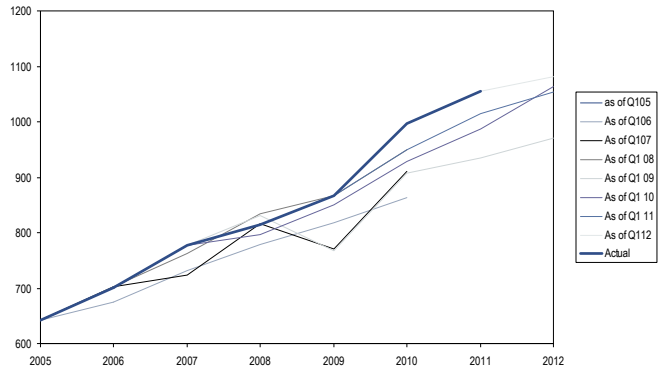
- **China (Scarlett Chen) –** Chinese domestic iron ore production is expected to keep expanding based on higher steel production, FAI in the ferrous industry and strong incentive prices.
- **Brazil (Alex Hacking) –** Brazil iron ore exports have grown at 8% CAGR in the past decade. This is a strong annualized rate over an entire decade – but results in recent years have lagged expectations. We expect 5-6 delivered projects to add 100-125mtpy new seaborne supply over the next 5 years (6% CAGR). Beyond 2016, the critical project will be Vale's 90mtpy Serra Sul expansion currently targeted for 2017, but with risk of delays.
- **Australia (Clarke Wilkins) –** Australia has been able to significantly increase iron ore exports over the last 5 years driven by expansions from RIO, BHP and the entry of FMG into the market. There are numerous iron ore projects underway or planned that should drive a further significant increase in supply from Australia – the key question going forward is not only how much supply can be delivered, but at what capex cost does it come.
- **India (Raashi Chopra)** - Indian production looks set to be overwhelmed by external issues. This is likely to result in declining production and exports over the next 2-3 years.
- **South Africa (Johann Pretorius)** – Infrastructure issues remain the key bottleneck. Transnet is increasing port capacity and rail by 13Mt to 60Mt, which should be completed by 2012 and a future expansion to 93Mt by 2017 is being discussed.
- **West Africa (Mike Flitton / Tom O'Hara)** – West African iron ore projects could add a further 350Mt of supply by the end of the decade. We believe there will be winners and losers and expect supply response of around 110Mt.

A full detailed write up is given in Appendix 1.

The demand and supply response so far

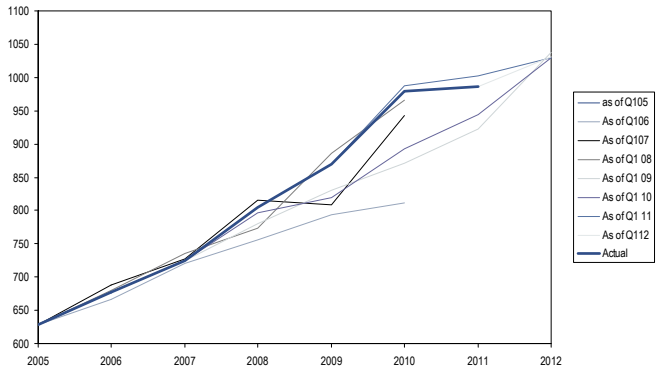
In comparing the actual demand for iron ore against our forecasts going back in history it is interesting to note the following:

Figure 62. Global Iron Ore Imports – forecast versus actual (Mt)



Source: Citi Investment Research and Analysis

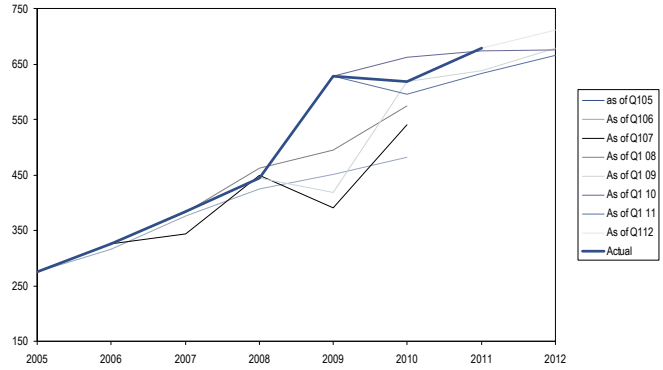
Figure 63. Global Iron Ore Exports – forecast versus actual (Mt)



Source: Citi Investment Research and Analysis

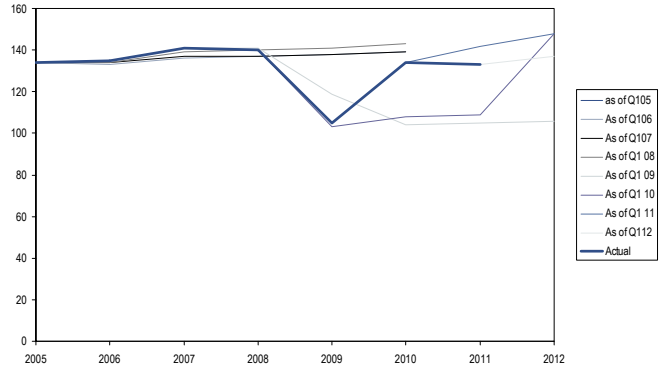
On a regional basis Citi significantly underestimated Chinese demand for iron ore, particularly in 2009-11. Citi's forward forecasts in 2006-08 underestimated Chinese imports in the range of 200-300Mt, over the same period Citi over-estimated Japanese imports by around 40Mt.

Figure 64. Chinese Iron Ore Imports – forecast versus actual (Mt)



Source: Citi Investment Research and Analysis

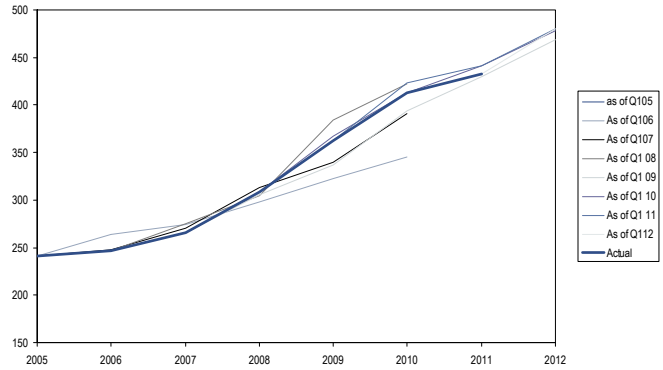
Figure 65. Japanese Iron Ore Imports – forecast versus actual (Mt)



Source: Citi Investment Research and Analysis

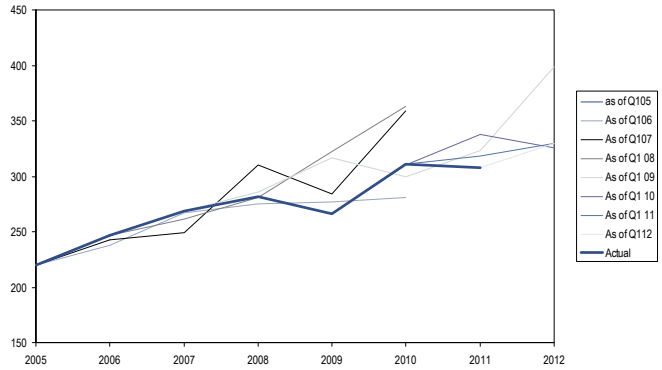
On the supply side, and taking a 3-year forward outlook Citi was generally more accurate in forecasting Australian iron ore supply, in contrast Citi significantly over-estimated the supply response from Brazil by 50-60Mt. In contrast, Citi significantly underestimated the supply response from South African and India by 30-40Mt.

Figure 66. Australian supply – forecast versus actual (Mt)



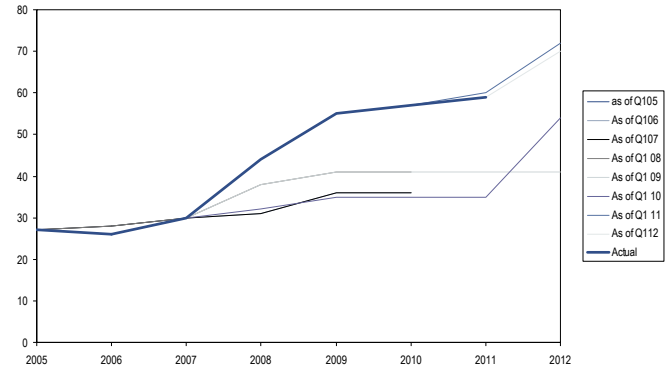
Source: Citi Investment Research and Analysis

Figure 67. Brazil supply – forecast versus actual (Mt)



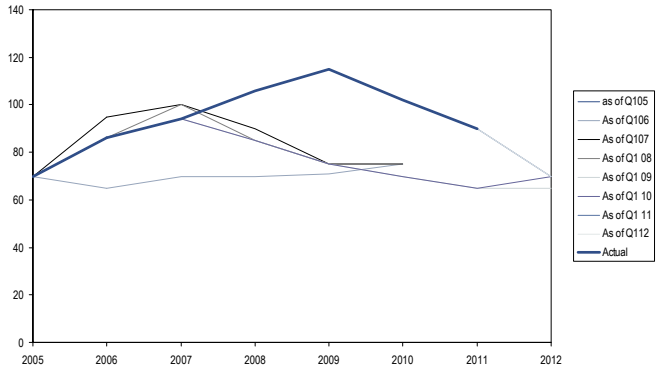
Source: Citi Investment Research and Analysis

Figure 68. South African supply – forecast versus actual (Mt)



Source: Citi Investment Research and Analysis

Figure 69. Indian Supply – forecast versus actual (Mt)

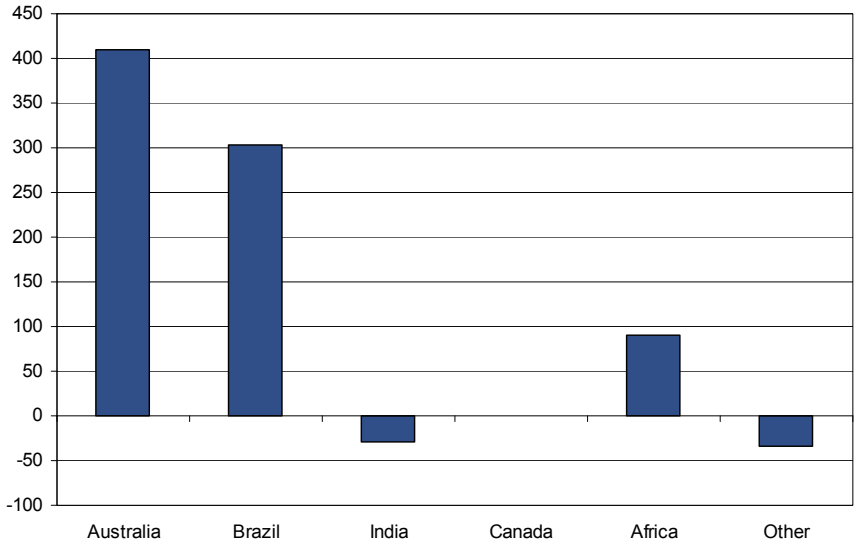


Source: Citi Investment Research and Analysis

The supply response going forward

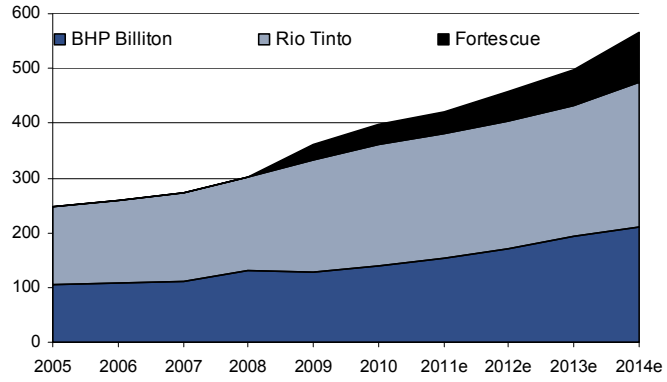
Our regional analysts, who are on the ground, have provided the following insights into the supply that is likely to occur in each of the major iron ore export regions going forward, with the individual write ups in Appendix 1. Overall, we expect an additional 739Mt of iron ore coming into the seaborne market by 2020 from the key regions of Brazil and Australia.

Figure 70. Citi – expected mine supply until 2020



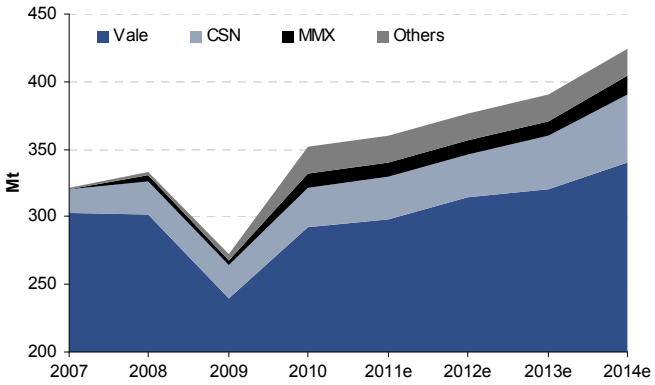
Source: Citi Investment Research and Analysis

Figure 71. Australian iron ore production by company



Source: Citi Investment Research and Analysis

Figure 72. Brazil iron ore production by company



Source: Citi Investment Research and Analysis

A breakdown, by producer and regions and a probability weighting is given in the following table.

Our Base Case Supply-Side Scenario

We think major Infrastructure costs and challenges will prevent some projects from reaching the market

Due to the challenges involved in getting many of these projects up and running, it's highly unlikely that every project in the supply pipeline will make into onto the market. Therefore, to build up our supply forecasts out to 2020, we have classed each project as either base case, probable or possible projects. We have then assigned probabilities to each of these categories based on our view of the quality of the projects (Figure 73).

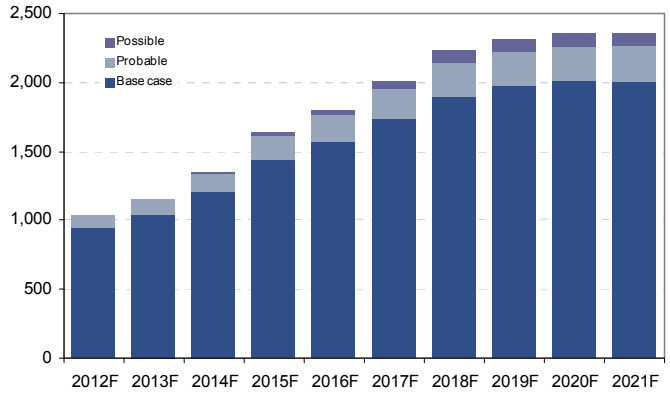
Base Case projects consist of those that have been announced and are being developed by the four major producers: BHP Billiton, Rio Tinto, Fortescue and Vale. Probable projects consist mainly of projects in Australia and Brazil by emerging producers, while possible projects are largely in Africa (the emerging iron ore region).

If we were to include just our base case projects, total capacity would reach nearly 2,000Mt by 2021 (Figure 73). If we included all probable and possible projects, this would balloon out to almost 2,400 Mt.

It's highly unlikely that all these projects will be developed. With significant challenges in bringing African supply online, where a bulk of the new projects will be built, we have assumed that only Base Case, 65% of probable projects and 40% of possible projects (Figure 73) will reach the market. That forms the basis of our expanded supply model (See Appendix).

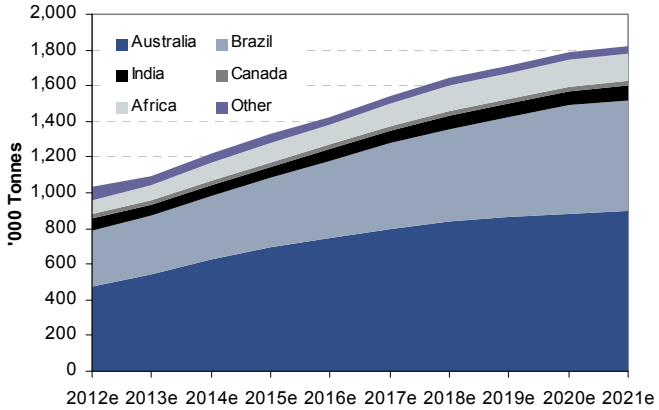
We then apply a utilisation factor to this capacity to obtain a final total export number.

Figure 73. Total Capacity of all Base Case, Probable and Possible Projects



Source: Citi Investment Research and Analysis

Figure 74. Forecast Iron Ore Exports by Country



Source: Citi Investment Research and Analysis

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Company Analysis

Companies with Quality Alpha

With the quality of iron ore product likely to gain in importance over the remainder of the decade, we profile those companies we think are set to benefit most from this long-term trend of product differentiation and defensive end markets. On a value in use (VIU) basis the premium product comes from ENRC, London Mining, Grange and Cliffs, while Vale is the pick of the majors. Combining VIU, the traditional cost curve and capital spend highlights the alpha plays; those companies with superior profitability and efficient capital allocation. Kumba, Rio Tinto and BHP are the stand out producers. Finally, screening on current valuation and profitability provides near-term top picks including Rio Tinto, BHP, London Mining, Vale and ENRC.

Value in use

The cost curve does not account for the price at which the product is sold and therefore its value in use

Looking at a company's position on the cost curve only tells half the profitability story negating as it does the price of the product sold and implicitly its quality. As described above, not all iron ore is created equal and the wide disparity between companies' products and their marketability on the international market is not captured on a traditional cost curve.

Product quality directly affects the price each iron ore producer is able to achieve relative to the global benchmark with lower Fe grades and impurities attracting discounts and penalties respectively (see Platts parameters in Figure 75).

Figure 75. Platts 63% Fe CFR China

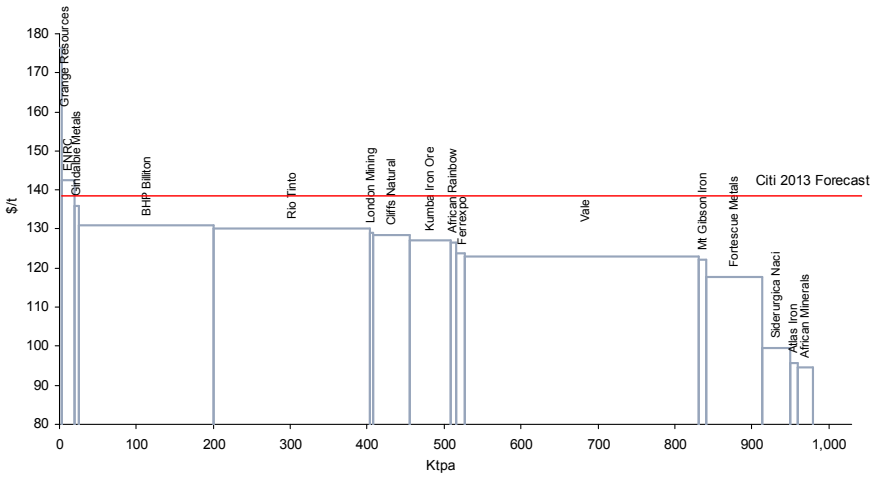
Parameter	Value
Iron content	63%
Moisture	8%
Silica	3.50%
Alumina	3.50%
Phosphorus	0.08%

Source: Platts

As Figure 76 shows the majority of companies achieve sales prices below our spot forecast of $138/t delivered to China as a result of freight and quality differences.

BHP has marginally the highest average realised price among the major iron ore producers with an expected sales/t of $131 in 2013

Figure 76. 2013E Achieved Price $/t vs. 63% Benchmark



Source: Citi Investment Research and Analysis

This assessment does however bias the picture towards those miners in closest proximity to China. As a result to evaluate independent product quality we have backed out freight to gain a clearer picture of mine gate value.

Backing out freight levels the playing field highlighting underlying product quality.

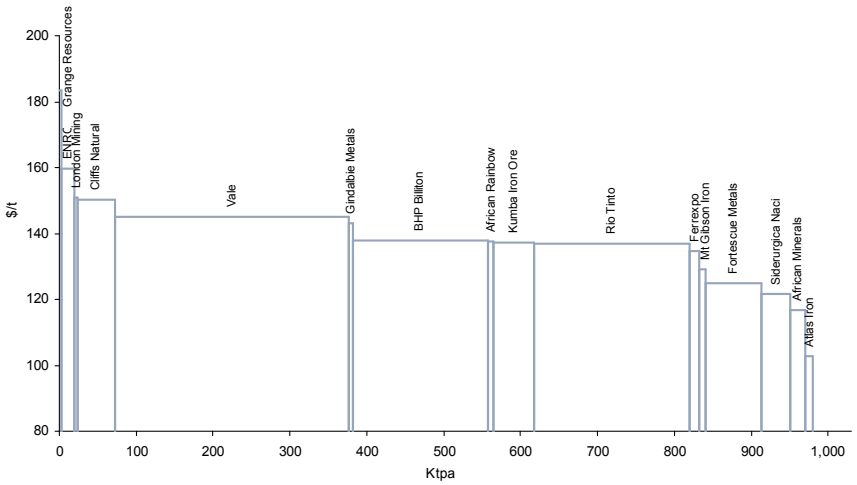
This levels the playing field between Vale and the Australian producers. As the below chart shows, Vale produces the highest quality iron ore, due to contribution from pellet, achieving prices c.$7/t over BHP/Rio FOB. The majors dominate the middle of the quality curve with the outliers the more junior players. At the top end ENRC, Cliffs, Grange Resources and London Mining screen the strongest while the weakest product comes from Atlas Iron with a cluster of lower-quality feed at c.$120/t from African Minerals, CSN and Fortescue. We would expect those companies to the left of Ferrexpo achieving prices in excess of the weighted average of c.$135/t to benefit over those on the right from the trend towards higher quality products.

The three majors all achieve prices between $137-145/t FOB in 2013 with Vale c.$7/t above Rio/BHP

Highest product quality: Grange Resources, ENRC, London Mining, Cliffs Natural and Vale

Lowest product quality: Atlas Iron, African Minerals, CSN, Fortescue

Figure 77. Product Quality - 2013E Average Realised Price Pre Freight



Source: Citi Investment Research and Analysis

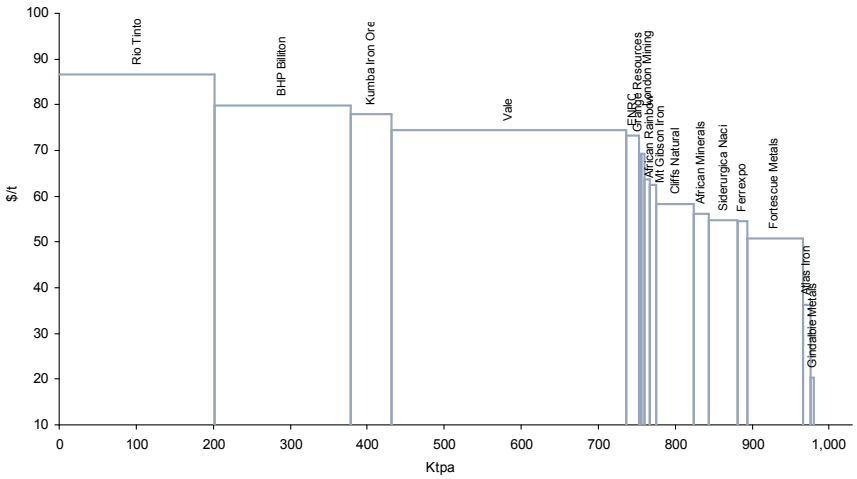
Where's the money made

Combining costs and value in use reveals Rio, BHP, Kumba, ENRC and Vale as the most profitable on a pre-tax basis.

Combining the cost and price curves generates a comparative profitability across the industry. While VIU indicates future structural demand outperformance investors care about near-term returns and so looking at EBITDA/t provides an all round evaluation. Rio Tinto's iron ore division is the most profitable generating $87/t of pre-tax EBITDA in 2013e, on our numbers. Below Vale's $74/t profitability falls away sharply to second-tier producers on c.$50-60/t. At the low end, Gindalbie and Atlas are the clear laggards with just $20 and $36/t of EBITDA, respectively.

Rio Tinto has the most profitable iron ore operations generating $87/t in 2013 in pre-tax EBITDA

Figure 78. Iron Ore EBITDA/t pre-tax 2013E



Source: Citi Investment Research and Analysis

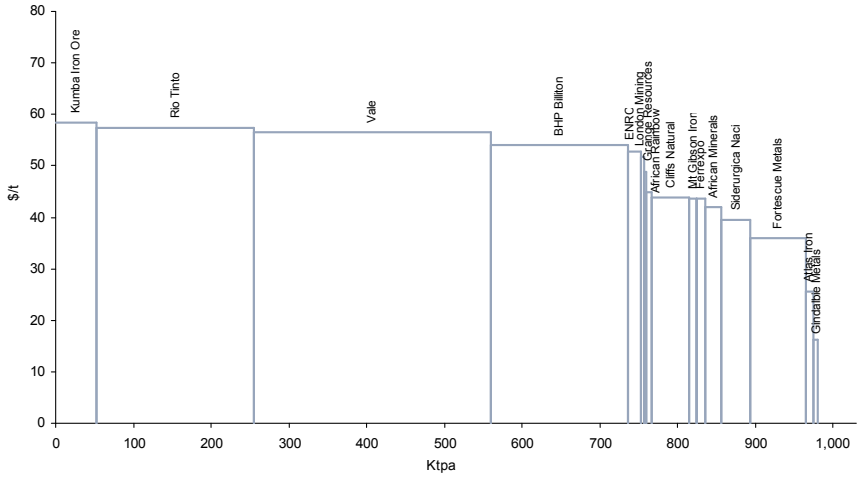
EBITDA post-tax is a more relevant profitability metric as it takes into account capital structure

Returns to shareholders are dependent on the capital structure and the prevailing tax regime of each company's operations however so EBITDA post-tax (we use group tax rate) is a more realistic assessment of value creation. This is especially relevant given the ongoing theme of resource nationalism within the industry.

The beneficiaries of this adjustment are Kumba, which becomes the most profitable operation and Ferrexpo, which has the lowest tax rate in the space at 20%. There is little to tell between the top producers with c.80% of production generating a similar post tax return of $50-60/t. While Vale is a clear winner on this basis, climbing from 5th to 3rd due to c.10pps lower tax rate vis-à-vis BHP and Rio, the company's outstanding tax disputes could result in higher rates in the future.

Ferrexpo, Kumba and Vale are the main beneficiaries on a post-tax basis with Kumba the most profitable company under our coverage

Figure 79. Iron Ore EBITDA/t post tax 2013E



Source: Citi Investment Research and Analysis

Efficient deployment of capital

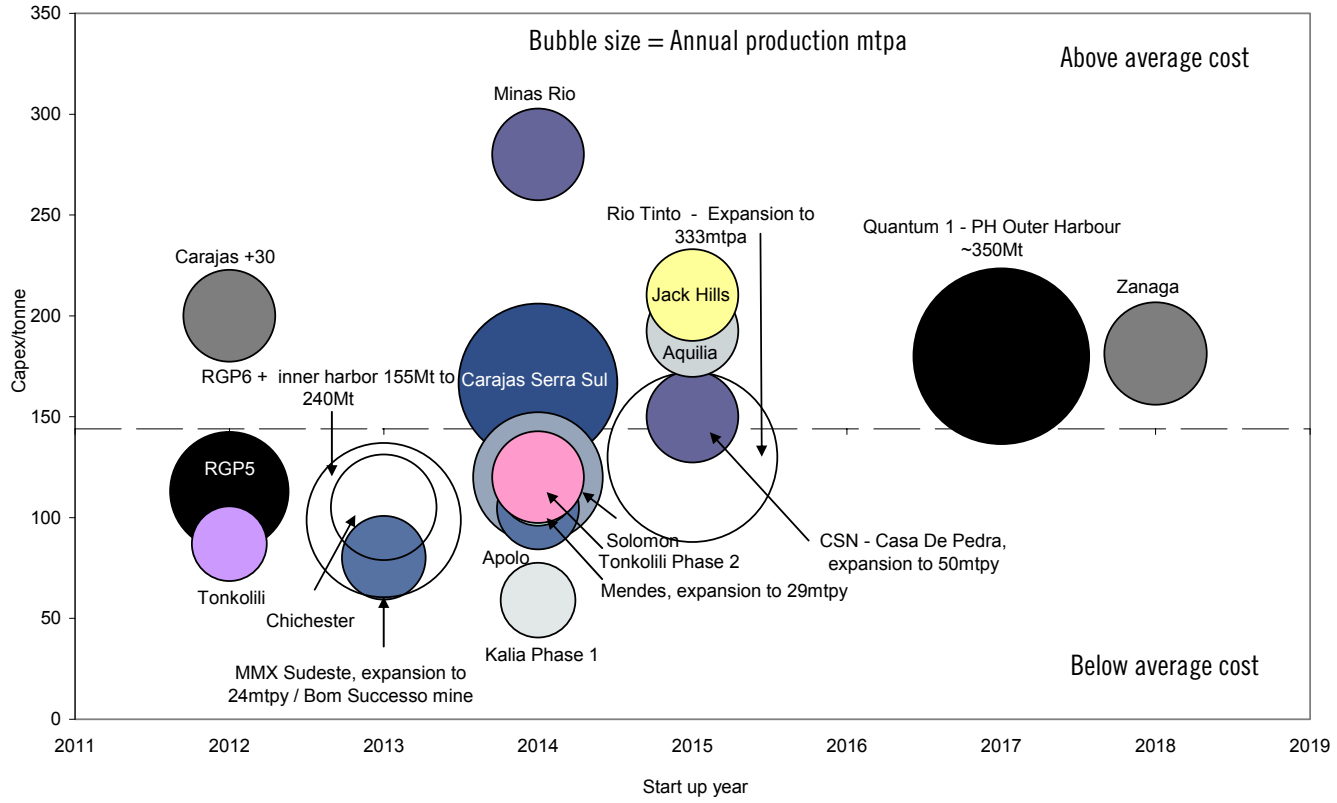
Despite the importance of profitability it needs to be put in the context of the capital spent to achieve it. With capital cost escalation an ongoing theme in the mining sector the relative efficiencies of each producer is critical in determining where the alpha lies.

A written summary of these major projects is provided at the end of the report

The bubble chart below highlights the largest projects – when they are expected to come on line, their cost as defined by capex/tonne of annual production, and the additional production tonnage targeted by the project.

In comparing this analysis to the report of last year, we note that the watershed year for project delivery has slipped from 2014 to 2015. Moreover, the capex per tonne has increased from an average of $124/t average to $132/t for all projects.

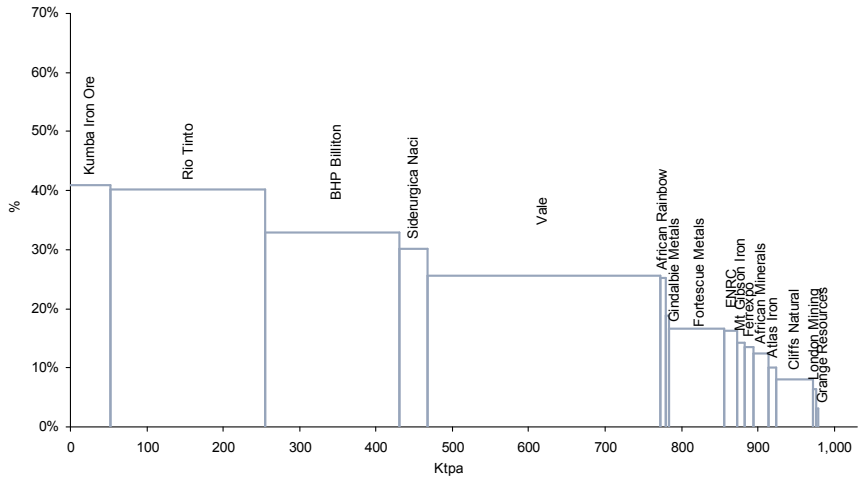
Figure 80. Capital Intensity ($/t)



Source: Citi Investment Research and Analysis

Given the industry-wide trend of escalating costs and commissioning slippage returns to shareholders will increasingly depend on the efficient deployment of capital. In Figure 81, we have ranked the companies under coverage by the average expected return on (iron ore) assets 2013-15e.

Figure 81. Average ROA% (Iron Ore Only) 2013-2015E



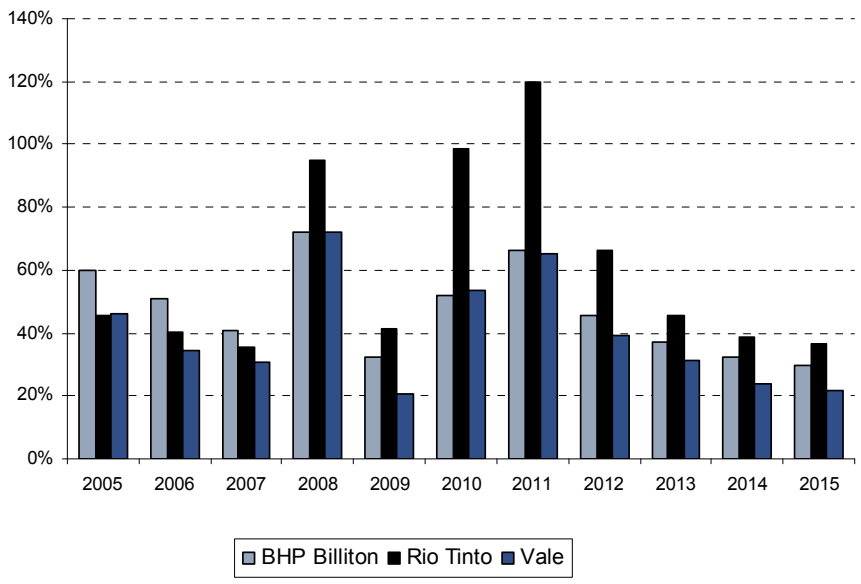
Source: Citi Investment Research and Analysis

There appears to be three tiers of efficiency in capital deployment. Rio Tinto and Kumba are the most efficient generating returns of c.40%, followed by BHP/CSN and Vale/African Rainbow on c.26%. The bottom tier comprises the remainder of our coverage, all sub-20% ROA, falling away sharply from ENRC, which generates 16% to just 3% for Grange Resources. While use of an average does help smooth expenditure with subsequent profits from those assets this analysis is likely to penalise those stocks, such as London Mining and African Minerals, which are in the process of multiphase build outs.

Vale: spending to stand still

The gulf between Rio and the other majors, BHP and Vale, results from a more efficient approach to capital deployment. Given the low value per tonne nature of bulk commodities, such as iron ore, infrastructure constraints are often a determining factor in project returns. Unlike BHP, Rio is effectively long infrastructure in the Pilbara allowing it to build out its 353 project at sub-average intensity, while BHP's Outer Harbour is closer to $200/t. We expect the ownership of this key comparative advantage to enable Rio to maintain ROA at c.40%, a similar level to 2005-07, out to 2015. This represents a 5-10pps advantage over BHP, which is likely to see returns drop to c.30% from an average of 51% in 2005-07.

Figure 82. The Majors: Iron Ore ROA%

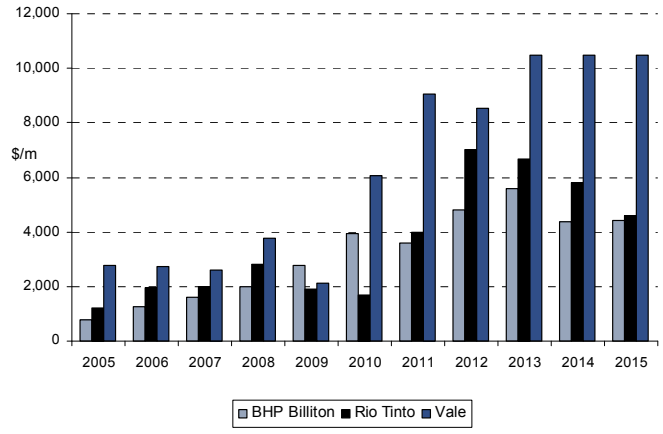


Source: Citi Investment Research and Analysis

However, of the three majors while Vale has kept pace with BHP on ROA% over the last 2 years, it is likely to be the laggard going forward. We expect returns to fall from 65% in 2011 to 22% by 2015. The reason for this is clear from the below charts, Vale has been spending just to 'stand still'.

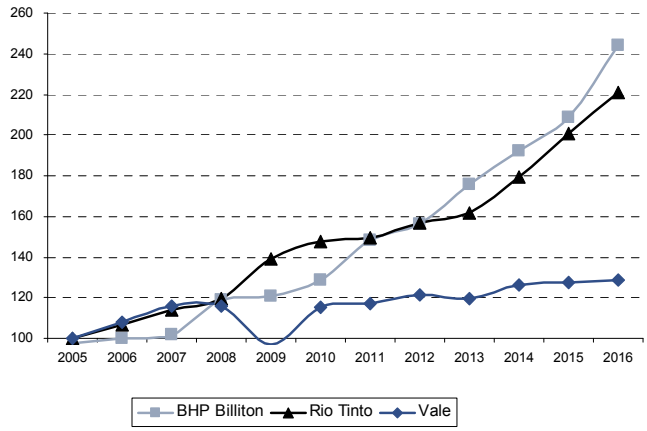
While the period from 2005-08 saw all three companies expand production by c.20% (Figure 84) Vale has struggled since then to bring on additional volumes. Over the next 5 years we expect the company to add just 29mt vs. an average of c.100mt each for BHP/Rio leaving the company in 2016 just 29% above the 2005 level. In contrast, BHP and Rio are 250% and 221%, respectively.

Figure 83. Capital Expenditure 2005-2015E



Source: Citi Investment Research and Analysis

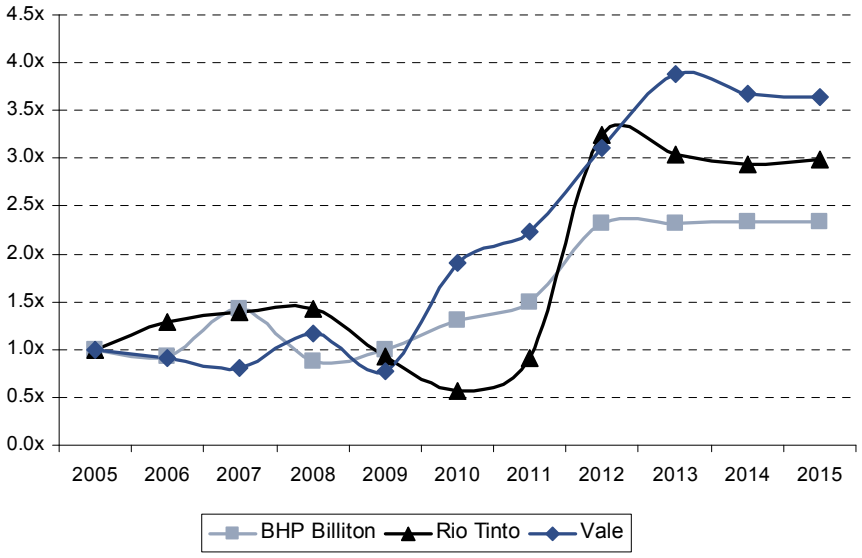
Figure 84. Iron Ore Production Indexed to 100 in 2005



Source: Citi Investment Research and Analysis

While capacity has stagnated the capital budget is set to grow from $2.7bn in 2005 to c.$10bn by 2013 (Figure 83). This implies what once was expansionary capex is now required simply to sustain the current run rate of operations. Since 2009 Vale's ratio between indexed 'stay in business' capex and indexed production (Figure 85) has risen ahead of BHP/Rio reaching 3.5x in 2013. The differential between the companies is in fact likely to grow over time, as this analysis does not take into account relative decline rates. Vale estimates it would lose 3-5% or c.12mtpa from production without investment. While we do not know the respective rates at the Australian producers, the limited production growth at Vale combined with escalating capex suggests it has the much higher rate as it spends money to replace lost tonnes rather than to achieve expansion.

Figure 85. Indexed Sustaining Capex / Indexed Iron Ore Production

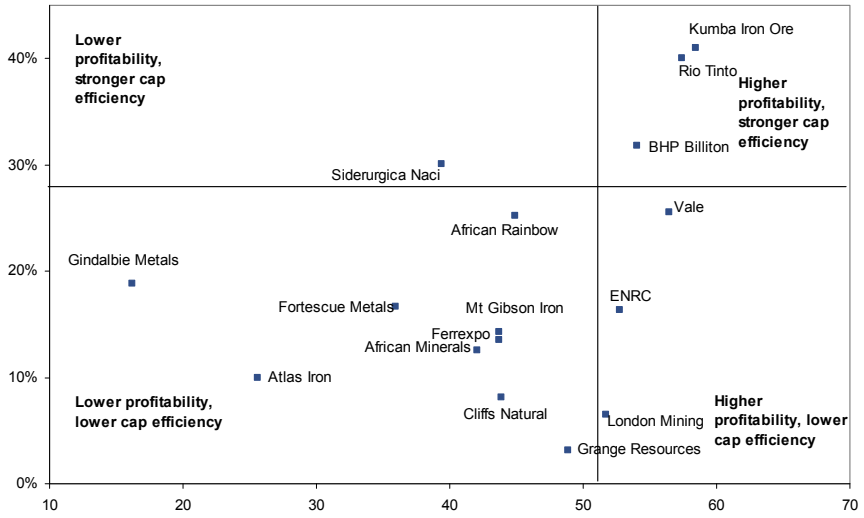


Source: Citi Investment Research and Analysis

Best-placed stocks

Which stocks then offer investors defensive growth and above-average-profitability as well as efficient capital deployment. As Figure 86 highlights, only Rio Tinto, BHP and Kumba offer a combination of these elements.

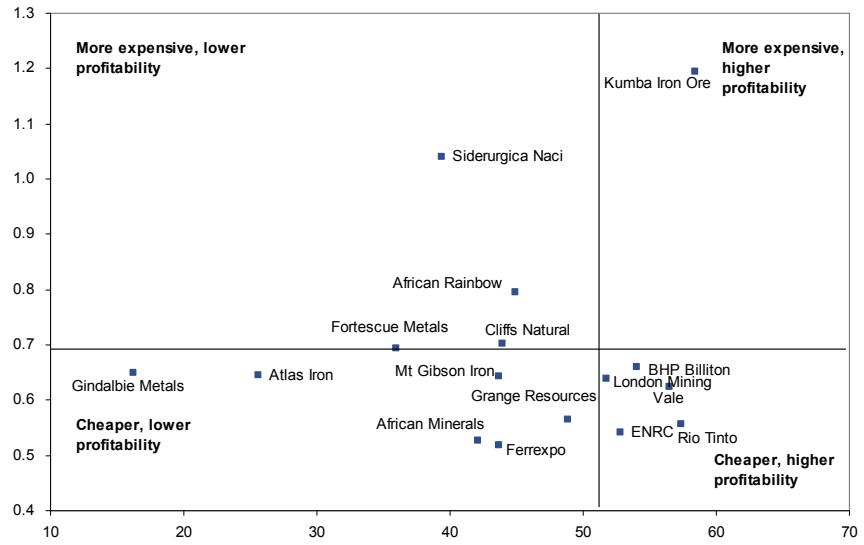
Figure 86. 2013-2015 Average ROA% vs EBITDA/t post tax 2013E ($/t)



Source: Citi Investment Research and Analysis

On a more actionable, short-term basis, screening on current pricing and profitability highlights Vale, London Mining, BHP, Rio and ENRC as stocks offering superior profitability and an attractive valuation. While Kumba is highly profitable with good ROA it is the most expensive stock in our coverage.

Figure 87. P/NPV vs EBITDA/t post tax 2013E ($/t)



Source: Citi Investment Research and Analysis

Figure 88. Full Project List

Project	Company/Region	Country	Timing	2015F production target (Mtpa)	Est. Capex (US$m)	Capacity	Capex per annual production unit (US$/tonne)
RGP6	BHP Billiton	Australia	2015	35	8400	35	240
Outer Harbour	BHP Billiton	Australia	2020+	0	19800	110	180
Expansion to 353mtpa	Rio Tinto	Australia	2015	60	19065	123	155
Chichester 2	Fortescue	Australia	2014	40	3600	40	90
Solomon	Fortescue	Australia	2014	30	6300	60	105
Atlas Iron	Atlas Iron	Australia	2013	6	672	6	112
Roy Hill	Hancock Prospecting	Australia	2015	20	9600	55	175
Southdown	Grange Resources	Australia	2017	0	2980	10	298
Marillana	Brockman Resources	Australia	2015	3	1900	17	112
Ironclad Mining	Ironclad Mining	Australia	2015	1		4	
Aquila	Aquila	Australia	2015	6	5775	30	193
Koolyanobbing Expansion	Cliffs Natural Resources	Australia	2012	3	320	3	107
Karara	Gindalbie/Ansteel	Australia	2012	10	3000	10	300
Sino Iron	Citic Pacific	Australia	2012	28	7500	28	272
Carajas +40 (+ logistics)	Vale	Brazil	2014	40	6445	40	161
Carajas Serra Sul (+ logistics)	Vale	Brazil	2017	0	19439	90	216
Carajas Serra Leste	Vale	Brazil	2013	6	478	6	80
Conceicao Itabiritos	Vale	Brazil	2013	12	1174	12	98
Vargem Grande Iabiritos	Vale	Brazil	2013	10	1645	10	165
Conceicao Itabiritos II	Vale	Brazil	2014	0	1189	19	63
CSN - Casa De Pedra expansion (+port)	CSN	Brazil	2015	10	3500	26	135
CSN - Namisa expansion	CSN	Brazil	2015	0	1500	14	107
MMX Sudeste (+ port)	MMX	Brazil	2014	12	3632	16	227
Minas Rio Phase 1	Anglo American	Brazil	2013	27	3800	27	141
Usiminas	Usiminas	Brazil	2015	8	2500	21	119
CAP expansion	CAP	Chile	2015	0	1100	12	92
Ved Exp		India	2012	40		40	
India Other Exports	India	India	0	25		25	
Askaf	Sphere Minerals	Mauritania	2011	4	540	6	90
Guelb el Auoj	Sphere Minerals	Mauritania	2015	7	1650	7	236
Lebtheinia	Sphere Minerals	Mauritania	2020	0		30	
Putu	African Aura	Liberia	2016	0		20	
Tonkolili Phase 1	African Minerals	Sierra Leone	4Q2011	12	1740	20	87
Tonkolili Phase 2	African Minerals	Sierra Leone	2015	23	3600	30	120
Tonkolili Phase 3	African Minerals	Sierra Leone	2020+	0	7200	45	160
Marampa	Cape Lambert	Sierra Leone	0	5		11	

Marampa Phase 1	London Mining	Sierra Leone	1Q12	5	332	5	66
Marampa Phase 1a	London Mining	Sierra Leone	2015	4	600	4	150
Marampa Phase 2	London Mining	Sierra Leone	2016	0	1200	8	150
Isua	London Mining	Greenland		10	2820	15	188
Simandou	Rio Tinto	Guinea	2015	0	15200	95	160
Kalia Phase 1 DSO	Bellzone	Guinea	2014	20	1179	20	59
Kalia Phase 1 Conc	Bellzone	Guinea	2014	5		10	
Kalia Phase 2 DSO	Bellzone	Guinea	2015	0	552	10	55
Kalia Phase 2 Conc	Bellzone	Guinea	2018	0		10	
Mbalam	Iron Ore Junior	Cameroon	Q2 2014	30	3360	35	96
Mayoko	African Iron	ROC	2013	5	250	5	50
Avima	Core Mining	ROC	2016	5		20	
Zanaga	Zanaga	ROC	2015	0	6800	38	181
Nimba	ArceloMittal	Liberia	2012	14		14	
Faleme	ArceloMittal	Senegal	2020	0		15-25	
Kolomela	Kumba	S Africa	0	47	1133	70	24
Khumani	Assmang	S Africa	0	16	893	16	56
Yeristovskoye	Ferrexpo	Ukraine	2013	3.0	267	3	89

Source: Citi Investment Research and Analysis

Iron Ore market outlook

In our base case, we continue to believe that the Chinese economy will continue its measured slowdown and that construction activity and fixed asset investment will be supportive of steady growth in demand for iron ore. When combined with only near trend growth in exports from Australia and Brazil and weakening exports from India, we continue to see the market in an implied deficit.

But the iron ore market remains at an important juncture. Chinese steel production has recovered strongly in April but if the Chinese housing market continues to sour, steel and iron ore demand could come under further pressure later this year.

At the same time, the supply disruptions that we normally come to expect in 1Q have ended up being benign. Now with several producers expanding capacity, prices could struggle to move substantially higher from here.

After weighing up these factors, we feel the probability of rally in iron ore prices over the next three months or so is still high. But one mustn't ignore the tail risks in this market, which have the potential to produce wildly different prices scenarios.

Longer term, the significant project pipeline has the ability to supply the market under any demand scenarios. But the challenges, including logistics, country risk, and ore quality, remain immense. We believe barely half of these projects will make it into the market by 2021.

Developing Asia (including China) and Africa will be the fastest growing regions, in our view, driven by population and income per capita growth. If steel intensity of use follows trends seen in developed economies, iron ore demand from these regions would hit 1300Mt by 2020, representing a CAGR of 8%. This should keep in check the surplus in the iron ore market post 2015.

Demand picking up but remains fragile

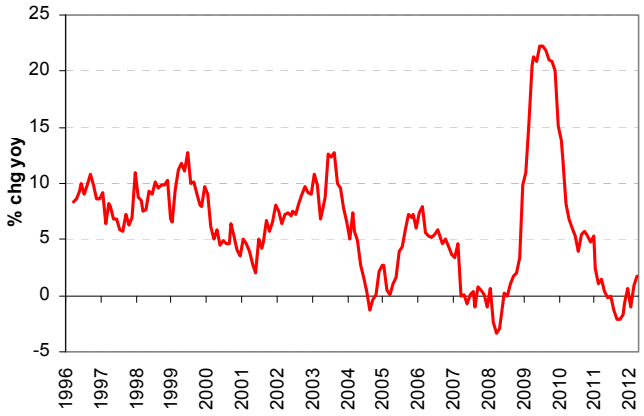
The slowdown in the Chinese economy has had an immediate impact on the demand in key sectors such as construction and manufacturing. This has resulted in key commodity consuming end uses recording record low growth rates in early 2012.

After starting of the year with a bang, growth rates in fixed asset investment have nearly halved to 22% in recent months.

Chinese residential construction remains a drag on demand

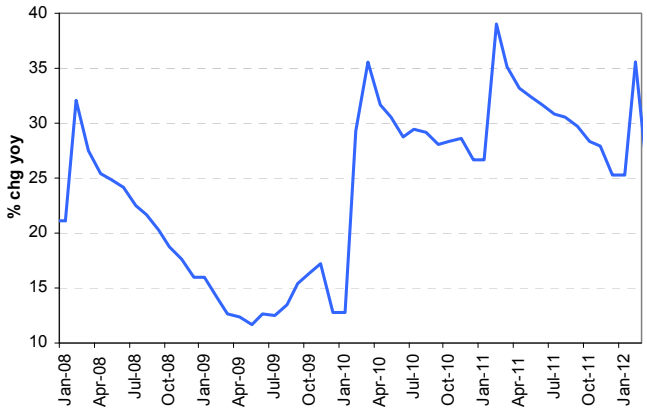
Construction is still the dominant source of demand for steel in China – accounting for ~ 53% of steel demand. Since early 2011, monetary tightening and measures to curb property speculation had been put in place, putting the brakes on a decade-long boom in commercial and residential property. This drain in liquidity is apparent in the chart below, which depicts excess money supply (M2 less real GDP % yoy).

Figure 89. Chinese Excess Money Supply



Source: Bloomberg, Citi Investment Research and Analysis

Figure 90. A seasonal rebound in construction in Feb-12



Source: Bloomberg, Citi Investment Research and Analysis

Our China property team, led by Oscar Choi, notes, that despite earlier government interventions, annual transaction volumes grew at a 22% CAGR pace (from 2000 to mid-2011) and prices went up 127%. These trends started to turn down from Q2 2011 and turned clearly negative from September 2011. National residential land prices were flat in 4Q11 – 37 cities reported q/q negative price developments, up from 12 in 1Q11.

Transaction values are down 20.9% yoy in Jan-Feb 12 with the residential segment underperforming (-24.7%). Volumes are down 14% yoy to 70mn sq m GFA and residential is the laggard again with volumes down 16% yoy. But during Golden Week (a traditional selling period), the average number of units transacted was up 46% YoY. It was also a relatively broad-based rebound in Tier 1 and 2 cities. But with inventories relatively high, project construction starts by the major property developers are forecast to decline 2% in FY12 (China Property - Inventories Peaked, Over-Supply Improving in Key Cities).

Forecasts from our China property team suggest that at least the residential element of the property complex will be down yoy as far as volumes are concerned. The team is looking for a 19% yoy drop in gross floor area under construction in 2012. While residential construction is less steel intensive than infrastructure, a negative yoy progression will have a negative impact on steel demand in China.

We are looking for a 19% yoy drop in Chinese GFA in 2012

Figure 91. Citi's forecast for gross floor area under construction in China

mn sq metres GFA	2009A	2010A	2011A	2012E
Commodity Housing	1006	1408	1491	1268
Social Welfare Housing	148	230	410	273
Total housing	1154	1638	1901	1541
% yoy		42%	16%	-19%

Source: Citi Investment Research and Analysis

Our China economists believe that restrictive policies on the property sector will be maintained until the majority of the 70 cities monitored by the NBS (National Bureau of Statistics) show a yoy price decline. 2012 will likely remain challenging for the physical market but a 10% ASP drop is more likely than the market's more bearish view of a 20-30% ASP drop.

Social housing targets (7mn units to be started in 2012) will remain in place and reforms of real estate tax and household registration will be introduced. A near-term relaxation of these curbs is likely, and also what the market expects. Given the fall in ASPs, there could some selective relaxation of policy to relieve the pain of local governments.

Indeed, a slightly recovery is already underway. Transaction volumes improved in February and developers have withdrawn discounts in some cities with a view that demand will pick up in the post Chinese New Year period. Mortgage premiums over the base rate have contracted too – currently at 5% over base rate in Chongqing vs. 10% previously – a reflection of looser monetary conditions.

Some signs of a recovery in property sector confidence, but policy remains fairly restrictive

Premier Wen's speech at the 11th NPC has delivered limited surprises and appears to be in-line with our China team's expectations. The overall policy of curbing property speculation will remain in place. Residential construction activity is likely to be a drag for steel demand in China until Q3 2012 when the current restrictive policies may be relaxed.

Chinese auto production – March data stalls

Chinese auto production bounced back in February. Our autos team estimates China Apr-12 car sales grew 13% YoY to about 896,671 units, based on China Auto Market data. Car sales declined 4% MoM which is lower than 10-year April average of 1% MoM growth. Overall, Jan-Apr 2012 car sales grew 1% YoY. The May data will be a key data point to watch, and our China team is looking for +10% yoy in auto sales data as evidence that the growth slowdown has ended.

In addition, the Ministry of Finance, State Administration of Tax and MIIT have announced the Fuel Efficient and New Energy Vehicle and Vessel Tax Policy. Effective immediately, the Vehicle and Vessel Tax (an ownership tax paid annually) will be reduced to zero for eligible vehicles. These include 49 fuel efficient passenger vehicle variants, 154 pure electric commercial vehicles, three plug in hybrids and four fuel cell commercial vehicles. Our China autos team believes that this policy will be mildly positive for passenger vehicle sales.

Tax breaks for fuel efficient vehicles are being introduced in China

Post Chinese New Year, truck sales data has rebounded too due to the shorter Feb-11 base effect and New Year timing. 2M12 sales are still down 28% yoy and given previous HDT (heavy duty truck) sales downturns have lasted for 12 consecutive months, the March data will be key to gauge if the current downturn is behind us or not. Specialty trucks used in mining and construction continued to decline yoy – down 11% in Feb-12, although much less that the -55% yoy print in Jan-12.

Figure 92. Mining/Construction truck sales continue to be weak

China HDT sales by type	Feb-12	Jan-12	Dec-11	Feb-11	% yoy	% m/m
Standard truck (short haul logistics)	25463	11851	16206	24686	3%	-26.9%
Semi-tractor trailer (long haul logistics and import/export)	25814	12274	15933	25814	27%	-23.0%
Specialty trucks (mining, construction)	26842	13876	23990	26842	-11%	-42.2%

Source: China Auto Market, CAAM

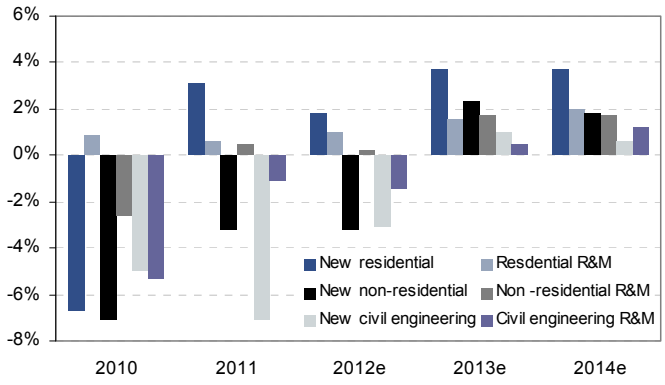
A European recovery unlikely this year…

A recovery in European construction is unlikely in 2012 and is only likely to begin in 2013, before picking up pace in 2014. This is, quite simply, a multi-year debt work-out.

After a modest contraction in 2011, our European construction team expects construction output to fall by 0.4% in 2012. The North-South divide is expected to continue with growth in Germany and France (1.8% and 1.7%) and weak numbers for the south (-9% for Spain, -1.5% for Italy and -12.9% for Portugal). There is common ground with the US – residential construction was the strongest sub-sector in 2011 while public sector construction is the laggard, again.

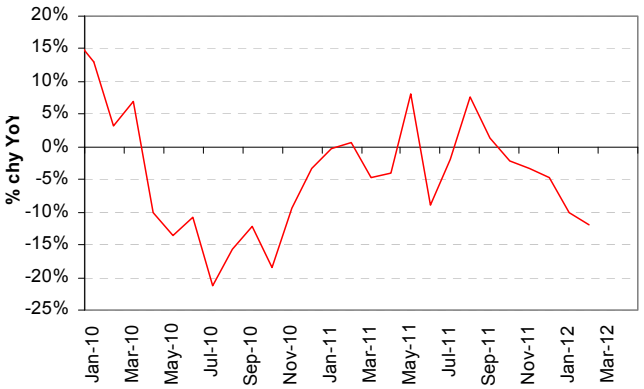
New car registrations have already turned negative in Europe (down 10% yoy in Mar-12) and even strong markets like Germany are barely registering positive growth. France has been the worst hit of the major car markets – down ~20% yoy in March 2012, although it has shown signs of stabilisation with sales only falling 1% YoY in April. Our autos team is forecasting a 5% decline in passenger vehicle markets in 2012.

Figure 93. Euroconstruct forecasts – similar pattern to the US – strong in residential and weak in public sector



Source: Euroconstruct, Citi Investment Research and Analysis

Figure 94. A poor start to 2012 for European auto sales



Source: Bloomberg, Citi Investment Research and Analysis

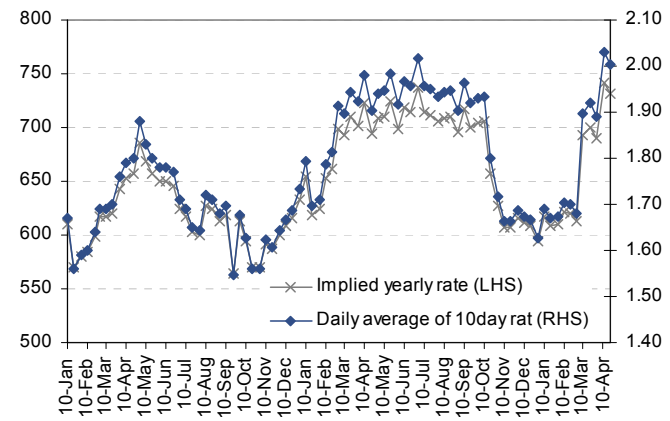
Indicators point to improvement over coming months

Major steel mills have stopped cutting capacity; which has shown up in the latest steel production figures issued by China's CISA showing that daily production in early March was 1.71Mt per day (Figure 95).

Recently out Chinese-based colleagues visited steel mills in Hebei and found utilisation has been rising since February and mill inventory is decreasing. Inventory peaked in mid February, and then gradually fell back. Loosening liquidity and improving seasonality also appears to be helping.

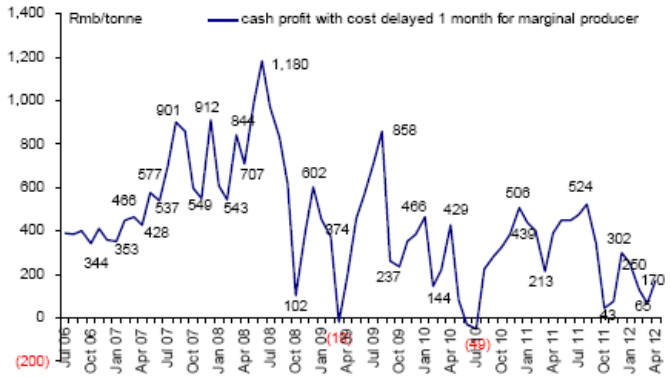
Improving economics in the steel industry could help improve demand. While Hebei mills are making a gross profit of zero to -Rmb100, we think they should be breaking even over the coming months (Figure 96).

Figure 95. China Daily Steel Production



Source: CISA, Citi Investment Research and Analysis

Figure 96. Cash Profit for a marginal rebar producer



Source: Citi Investment Research and Analysis

To what levels Chinese steel production rebounds to is the key to how the iron ore market will perform in 2012. A bull case scenario would be if steel production tracks a 2007-like path, the IISI data should pick up by ~11% from the Feb NBS data to 62.1mn tonnes and peak at 65-66mn tonnes mid-year. This path would get us to full year production of 752mn tonnes, up 9.9% yoy.

We suspect a more reasonable scenario would be similar to 2010, with a pick-up in Q2, peak production in May and production beginning to tail off in Q4. This would get us to full-year production of ~ 693mn tonnes, up 1.5% yoy. This seems to marry up with what we are seeing in the latest CISA data (Figure 95).

We also believe that some crude steel production is slipping through the data collection net. We think it is likely that several smaller furnaces, including recently constructed ones are not captured in the CISA/IISI reporting. It is hard to put an exact number to this problem, but we think there could be 20-30mn tonnes of under-reporting. Our forecast of 723Mt is split into 693Mt as the IISI number (the number the market will track) and a 30Mt adjustment to reflect under-reporting of production.

Steel capacity growth slows

Our base case is for slowing capacity growth to tighten the steel market in 2013 (Figure 97). But until then, demand from developed economies is set to remain weak.

- We recently made changes to our steel supply/demand model. Our estimates for Chinese capacity were revised up to 810mn tonnes in 2012, although the overall trend of sharply slowing capacity growth remains intact. Production is now forecast at 728Mt in 2012.
- We have also factored in the capacity closures that have been announced in Europe, by and large from ArcelorMittal.
- Lastly, we have incorporated the lower GDP forecasts from Citi's economists.

We see the global steel market staying oversupplied in 2012, although we expect the slowing capacity growth to result in a very strong steel market in 2013 and 2014.

China

In the short term, we believe steel prices, production and steel mills' profitability should all find a bottom. Restocking or demand recovery could trigger a price rally, and we anticipate this by 2Q12.

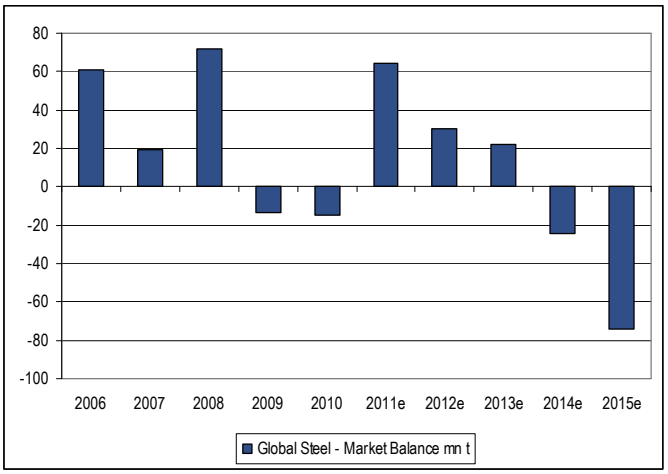
Longer term we remain convinced that China has reached peak capacity and that as economic growth begins to slow, steel output will revert to a more sustainable level:

Our analysis of US steel production from the 1960s to date tells us that US needs only half of its peak capacity, with the country moving to a post-development phase. We envisage peak production for China by the end of the 12th FY at around 850 Mt. Thus we calculate that China will only require about 425 Mt of steel capacity for the long term.

We forecast 5.0% growth in steel capacity and 6.7% of growth in demand in 2012. Utilization should trend up; however, the homogeneity of product and the irrationality of producers kill profitability.

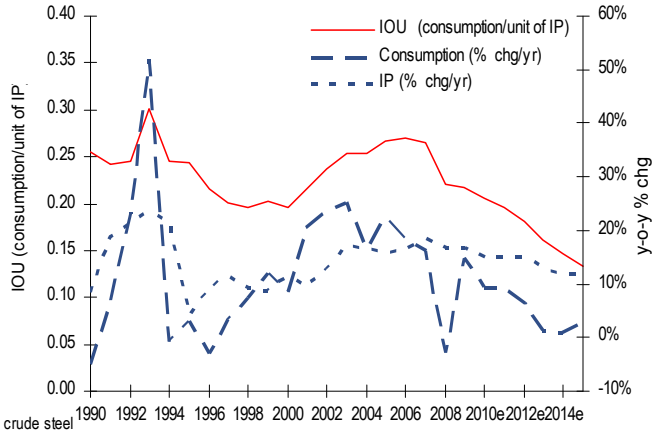
Capacity expansion is on hold; however, we do see new capacities ramping up, in the name of technology renovation, or environmental compliance replacing small furnaces with large ones. Hebei, standing alone, has a pipeline of 21 Mt, 13% of the existing capacity.

Figure 97. We see the possibility of a fairly tight steel market in 2013 and 2014



Source: CRU , IISI , Citi Investment Research and Analysis

Figure 98. China Steel Intensity and Consumption Forecast



Source: NBS, Bloomberg, Citi Investment Research and Analysis

Europe

The European construction market is likely to have a very poor 2012, in our view. The last Euroconstruct forecasts stood at +4.4% growth in W. European construction in 2012. We think this will probably be revised down and our view is flat at best and down 2-3% realistically. Country forecasts that look most vulnerable to downgrades are France (+2.95% forecast), Germany (+9% forecast), Italy (+6.6% forecast) and Spain (+5% forecast). With governments tightening their belts across the board, the hit should be much more on infrastructure and public sector spending, which are typically more steel intensive than residential construction.

North America

We see some marginal improvements in US construction data. Josh Levin, our US homebuilder's analyst, points out that the inventory of existing homes for sale has been declining for 8 months, and now stands at multi-year low.

The current inventory of 3.48mn homes does not include the so called “shadow inventory” of homes in or on the brink of foreclosure, but it is hard to put a negative spin on the drop in inventories. Josh argues that at the margin, the inventory statistics are bullish for US homebuilders and should help pricing.

US construction spending is also showing signs of improvement and the September housing starts data was the highest headline start since April 2010. The improvement was driven by multi-family starts – the rental market is strong and is attracting new construction.

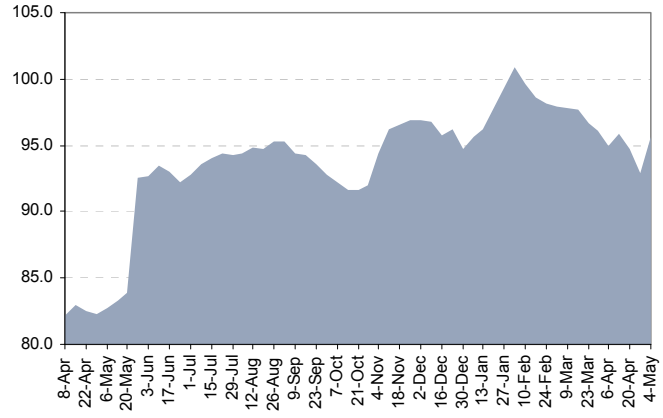
In the same vein as construction, auto demand from the US seems to be performing better than expected. Our US autos analyst, Itay Michaeli, notes that April SAAR is running at 14.4m units (up from March) and the Japanese majors are regaining market share. We continue to look for 2012 SAAR at 13.9mn units, up 8.5% yoy – a rare bit of good news for metal and steel demand in the western world.

High inventory could curb appetite to buy more

Global ore inventory is high, curbing the appetite to buy more – Hebei mills have some 2 months inventory in-house. Other than that, the total inventory piled at port has reached 98 Mt.

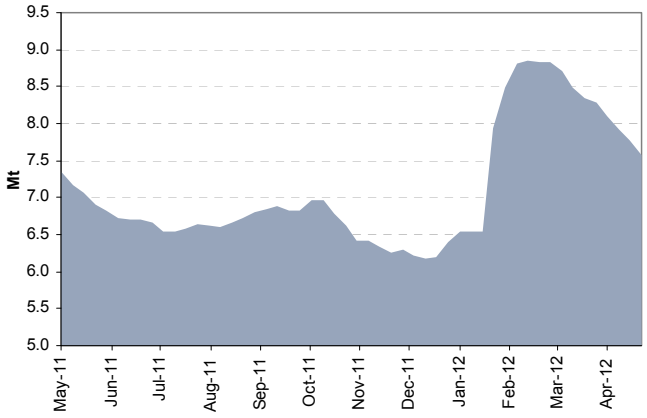
Inventories are also at healthy levels. Iron ore inventories at the ports have been falling this year but remain at elevated levels. The increase in 4Q11 correlated well with the bounce in prices, suggesting that some of this buying has not been for immediate consumption (Figure 99). At the steel mills, inventory of rebar and hot rolled coil are at relatively comfortable levels, despite having fallen from historically levels seen earlier this year (Figure 100).

Figure 99. Global iron ore inventories at the port are still on the rise



Source: Bloomberg, Antaike, Citi Investment Research and Analysis

Figure 100. Global Steel inventory



Source: Steelhome, Citi Investment Research and Analysis

Chinese domestic to remain a swing producer

As prices oscillate around fundamental support levels, we expected high-cost Chinese producers to be elastic in their response, as has been the case in the past. In 2008, when prices fell below $100/t, we saw a big fall in domestic production (Figure 101). Then as prices recovered in 2010 and 2011, so did output.

But over the longer term, domestic share is on a declining trend, falling below 15% in 2011 (Figure 102). This has been driven by strong demand in the developed economies rather than Chinese iron ore producers gaining market share due to lower costs and better quality iron ore. Strong demand from Europe and Japan has enticed shippers to divert ore to these stronger markets. As such, domestic producers have been forced to increase production to meet demand from Chinese steel mills. These producers have merely been acting as the industry's swing producer.

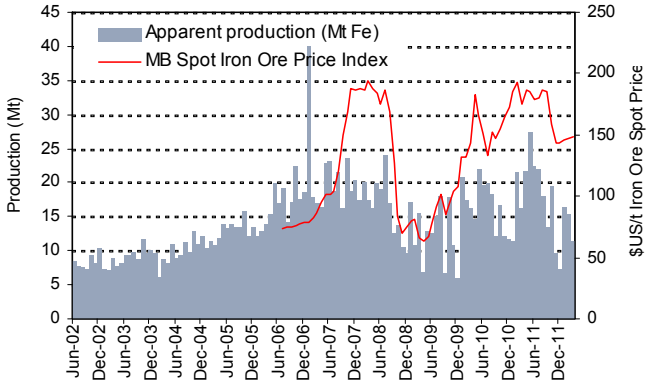
As growth in developed markets stabilises, and grade of domestic iron ore decreases, we would expect the share of domestic iron ore to continue its downward trend.

Estimating the grade of ROM ore is fraught with difficulties but on the ground estimates and statistics both point to a current average grade of around 20%. Increasing production is likely to result in a further decline in average grade. Notably, increasing production and declining grade have roughly balanced to keep production of iron units stable at between 250-300Mt.

In our forecasts we assume that increasing ROM production is balanced by declining grade, maintaining output of iron units at around 250Mt. Increased domestic production, supported by high prices, is one of the most likely sources of additional supply, which will close the projected market deficit over the next few years.

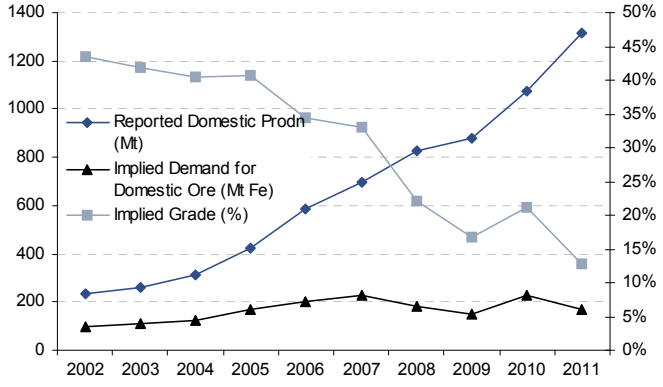
On the other hand, curtailments in high-cost Chinese production will be the balancing factor when the market goes into over supply from 2014.

Figure 101. Chinese Apparent Production vs Price



Source: China Customs, Bloomberg, Citi Investment Research and Analysis

Figure 102. Annual Chinese Iron Ore Production and Grade



Source: China Customs, Bloomberg, Citi Investment Research and Analysis

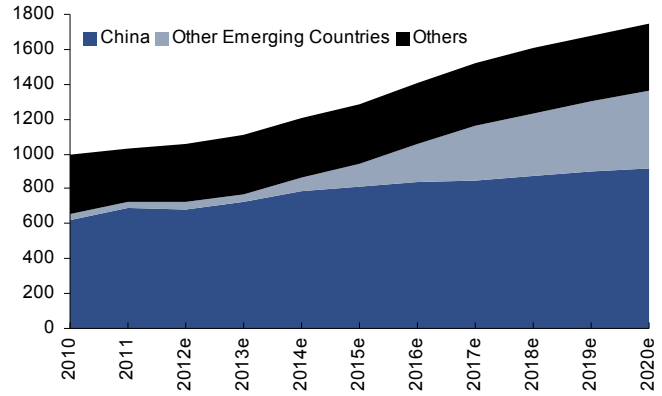
Longer-term demand boosted by Asia (ex-China)

We have taken a scenario approach to our forecasts for 2016-21. Developing Asia (including China) and Africa will be the fastest growing regions, in our view, driven by population and income per capita growth. If steel intensity of use follows trends seen in developed economies, iron ore demand from these regions would hit 1300Mt by 2020, representing a CAGR of 8%. This should keep the surplus in the iron ore market in check post 2015.

Our economists expect strong growth in the world economy until 2050, with average real GDP growth rates of 4.6% pa until 2030 and 3.8% pa between 2030 and 2050. Developing Asia and Africa will be the fastest growing regions, in our view, driven by population and income per capita growth, followed in terms of growth by the Middle East, Latin America, Central and Eastern Europe, the CIS, and finally the advanced nations of today.

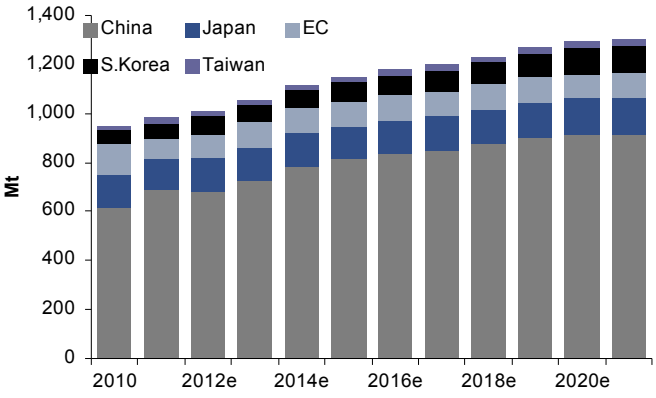
But countries such as Bangladesh, China, Egypt, India, Indonesia, Iraq, Mongolia, Nigeria, Philippines, Sri Lanka and Vietnam have the most promising (per capita) growth prospects, we believe.

Figure 103. Iron Ore Demand by Region



Source: Citi Investment Research and Analysis

Figure 104. Iron Ore Imports by Country



Source: Citi Investment Research and Analysis

Overall balance market over the next decade

Despite an extensive project pipeline, a combination of stronger demand from 3G economies, as well as project delays, should see the expected market surplus remain in check.

We are still forecasting the market to move into surplus in 2015, but after a wave of Australian projects ramp up, the market should quickly swallow up the excess supply as demand from the 3G economies kicks in.

A market surplus of between 15Mt and 35Mt should ensue until 2021, as a surge in supply from a crop of African projects hits the market. After which, the market returns to balance (or even deficit). As a consequence, we don't feel there is enough pressure to prices below this LT price over our newly extended price forecast period.

Figure 105. Base Case Supply/Demand Market Balance

Mt	2009	2010	2011e	2012e	2013e	2014e	2015e	2016e	2017e	2018e	2019e	2020e	2021e
SEABORNE IMPORTS													
China	628	619	687	682	729	783	815	838	850	876	902	915	913
Japan	115	134	128	133	133	137	133	136	139	141	144	147	150
Taiwan	12	19	21	19	19	20	20	21	23	24	26	27	29
EEC	81	120	81	101	102	102	102	102	101	101	101	101	101
USA	4	6	5	11	11	11	12	12	11	11	11	11	11
Others	62	98	106	113	113	153	202	299	401	451	495	549	591
Total	**902**	**996**	**1,028**	**1,059**	**1,107**	**1,207**	**1,284**	**1,407**	**1,524**	**1,604**	**1,678**	**1,750**	**1,795**
% change y-o-y		**10.4%**	**3.2%**	**3.0%**	**4.5%**	**9.0%**	**6.4%**	**9.5%**	**8.3%**	**5.3%**	**4.6%**	**4.3%**	**2.6%**
SEABORNE EXPORTS													
Australia	362	401	437	476	540	610	677	737	788	833	860	876	896
Brazil	266	311	331	313	330	360	387	438	486	521	558	609	615
India	115	102	90	70	65	60	62	66	69	72	76	80	84
Canada	28	28	25	25	25	25	25	25	25	25	25	25	25
Africa	55	59	59	70	83	100	107	111	126	143	146	149	152
Other	55	86	86	77	51	48	50	45	45	45	45	45	45
Total	**871**	**966**	**1,028**	**1,031**	**1,093**	**1,202**	**1,308**	**1,422**	**1,538**	**1,639**	**1,709**	**1,783**	**1,816**
% change y-o-y		**10.9%**	**6.4%**	**0.3%**	**6.0%**	**10.0%**	**8.8%**	**8.7%**	**8.2%**	**6.6%**	**4.3%**	**4.4%**	**1.8%**
MARKET BALANCE		-29.7	0.1	-28.0	-13.9	-4.3	23.3	14.9	13.5	34.6	31.0	33.3	21.1

Source: Citi Investment Research and Analysis

Figure 106. China's Crude Steel Production & Iron Ore Supply Assumptions

	2009	2010	2011e	2012e	2013e	2014e	2015e	2016e	2017e	2018e	2019e	2020e	2021e
Crude Steel Production*	599	654	713	725	748	767	806	830	855	881	907	934	962
Pig Iron Production	549	628	685	696	718	736	774	797	821	846	871	897	924
China Imports (Mt iron ore @ 63%)	628	619	687	682	729	783	815	838	850	876	902	915	913
China Imports (Contained iron)	396	390	433	431	457	493	511	526	534	550	566	574	573
% share of total consumption	71%	61%	61%	62%	63%	67%	65%	66%	65%	65%	65%	64%	62%
Domestic Production													
ROM	880	1,072	1,315	1,426	1,390	1,294	1,439	1,486	1,591	1,656	1,722	1,843	2,023
Contained Fe	158	243	269	266	261	243	268	274	290	299	308	326	355
% Fe	18%	23%	20%	19%	19%	19%	19%	18%	18%	18%	18%	18%	18%
Inventory	67	77	93	93	96	96	101	104	107	110	114	117	121
Ore stocks change (Mt of ore)	7	9	16	0	3	0	5	3	3	3	3	3	4

Source: Citi Investment Research and Analysis * Chinese steel production includes unreported amounts as estimated by Citi Research

Understanding the pellet premium

We view the pellet premium over fines as dollar based rather than percentage based, as we expect it to be more stable while iron ore prices decline, underpinned by the cost of converting to pellet

One of the more opaque aspects of iron ore pricing is the premium paid for pellets over fines or concentrate. Sometimes viewed as a percentage premium, we prefer to view it as a dollar premium, as we expect the dollar amount of a pellet premium to be more stable than iron ore prices as they trend downwards. However, pellet premiums can be volatile and have reached as high as $60/t and effectively as low a $0/t in the past. Generally the premium for pellet over fines ranges between $15-30/t. Like iron ore pricing, we expect the cost of pellet conversion to underpin the pellet premium.

The cost of pelletising

We have built a pelletising cost function, based on the following inputs:

Figure 107. Pellet Conversion Cost Function – Key Inputs

Price Inputs		2011	2012E	2013E	2014E	2015E	2016E	2017E	2018E	2019E	2020E
US Gas (Henry Hub)	$/MMBTU	4.01	2.45	3.53	5.60	5.74	5.89	6.03	6.18	6.34	6.50
US Gas	$/m3	0.14	0.09	0.12	0.20	0.20	0.21	0.21	0.22	0.22	0.23
European Gas	$/Mcm	390	390	390	390	400	410	420	430	441	452
European Gas	$/m3	0.39	0.39	0.39	0.39	0.40	0.41	0.42	0.43	0.44	0.45
Electricity	$/kWh	0.10	0.10	0.10	0.11	0.11	0.11	0.11	0.11	0.12	0.12
Alloy Steel	$/t	1,500	1,530	1,561	1,592	1,624	1,656	1,689	1,723	1,757	1,793
Process Inputs		**2011**	**2012E**	**2013E**	**2014E**	**2015E**	**2016E**	**2017E**	**2018E**	**2019E**	**2020E**
Electricity Consumption per tonne concentrate input	kWh/t	20	20	20	20	20	20	20	20	20	20
Gas Consumption per tonne concentrate input	m3/t	18	18	18	18	18	18	18	18	18	18
Recovery to Pellet	%	95%	95%	95%	95%	95%	95%	95%	95%	95%	95%
Spare steel parts per tonne concentrate input	g/t	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
Process Outputs		**2011**	**2012E**	**2013E**	**2014E**	**2015E**	**2016E**	**2017E**	**2018E**	**2019E**	**2020E**
Concentrate required for 1 tonne	t	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05

Source: Citi Investment Research and Analysis

Our gas consumption per tonne input of 18m3 is based on the assumption that the pelletiser is running at, or close to, full capacity. The same applies to our electricity consumption input of 20kWh/t.

Figure 108. Pellet Cost based on European Natural Gas price ($/t)

Total Costs		2011	2012E	2013E	2014E	2015E	2016E	2017E	2018E	2019E	2020E
Gas Costs	$/t	7.39	7.39	7.39	7.39	7.57	7.76	7.96	8.16	8.36	8.57
Electricity Costs	$/t	2.11	2.15	2.19	2.23	2.28	2.32	2.37	2.42	2.47	2.52
Other costs (personnel, spare parts)	$/t	5.02	5.12	5.22	5.33	5.43	5.54	5.65	5.77	5.88	6.00
Total Costs	**$/t**	**14.51**	**14.66**	**14.80**	**14.95**	**15.29**	**15.63**	**15.98**	**16.34**	**16.71**	**17.08**

Source: Citi Investment Research and Analysis

We do however see the US cost of pelletizing much lower, due to significantly lower gas prices.

Figure 109. Pellet Cost based on US Natural Gas price ($/t)

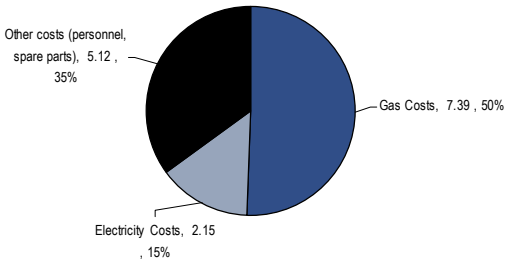
Total Costs		2011	2012E	2013E	2014E	2015E	2016E	2017E	2018E	2019E	2020E
Gas Costs	$/t	2.68	1.64	2.36	3.75	3.84	3.94	4.04	4.14	4.24	4.35
Electricity Costs	$/t	2.11	2.15	2.19	2.23	2.28	2.32	2.37	2.42	2.47	2.52
Other costs (personnel, spare parts)	$/t	5.02	5.12	5.22	5.33	5.43	5.54	5.65	5.77	5.88	6.00
Total Costs	**$/t**	**9.81**	**8.91**	**9.77**	**11.31**	**11.55**	**11.80**	**12.06**	**12.32**	**12.59**	**12.86**

Source: Citi Investment Research and Analysis

Cheap US shale gas implications: Pellet and DRI opportunities in North America could displace scrap

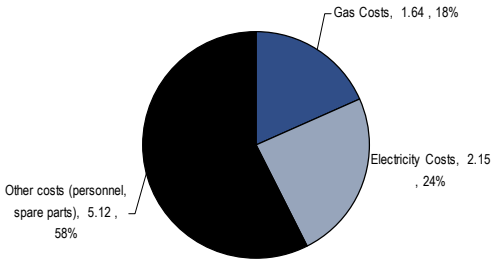
The significant differential in gas prices between North America and Europe is likely to create a gap between the cost of pelletising iron ore in the US versus doing so in Europe. On our forecasts the cost of pelletising in the US will be around $5-6/t cheaper than Europe, or ~30% cheaper.

Figure 110. European pelletizing cost breakdown



Source: Citi Investment Research and Analysis

Figure 111. US pelletizing cost breakdown



Source: Citi Investment Research and Analysis

This presents further downstream opportunities for the processing of iron ore, notably direct reduced iron (DRI). DRI plants generally take DR grade pellets (high Fe content pellets with combined silica and alumina of less than 3%) and with the use of reducing gases, remove the oxygen from the ferrous oxide. After the cost of iron ore, or assuming that a producer is integrated, the greatest cost in DRI production is natural gas. As natural gas accounts for most conversion costs, this is a technology that is more suitable for regions in which cheap gas supplies are available. As a result of lower gas prices in the US, we believe there will be opportunities for the DRI process to displace steel scrap as a feedstock for North American electric arc furnaces.

DRI Conversion costs

Figure 112 outlines the key inputs to our DRI conversion cost function. The parameters set out below are based on a typical Midrex furnace.

Figure 112. DRI Conversion Cost Function – Key Inputs

Price Inputs		2011	2012E	2013E	2014E	2015E	2016E	2017E	2018E	2019E	2020E
US Gas (Henry Hub)	$/MMBTU	4.01	2.45	3.53	5.60	5.74	5.89	6.03	6.18	6.34	6.50
US Gas	$/m3	0.14	0.09	0.12	0.20	0.20	0.21	0.21	0.22	0.22	0.23
European Gas	$/Mcm	390	390	390	390	400	410	420	430	441	452
European Gas	$/m3	0.39	0.39	0.39	0.39	0.40	0.41	0.42	0.43	0.44	0.45
Electricity	$/kWh	0.10	0.10	0.10	0.11	0.11	0.11	0.11	0.11	0.12	0.12
Iron Ore (67%)	$/t	-	150	145	135	125	115	110	108	105	105
Monthly Wage	$/month	3,333	3,333	3,417	3,502	3,590	3,679	3,771	3,866	3,962	4,061
Process Inputs		**2011**	**2012E**	**2013E**	**2014E**	**2015E**	**2016E**	**2017E**	**2018E**	**2019E**	**2020E**
Iron Ore Input (67%)	t	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45
Natural Gas	Gcal	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25
Natural Gas	m3	243	243	243	243	243	243	243	243	243	243
Electricity	kWh	100	100	100	100	100	100	100	100	100	100
Labour	h	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Maintenance/Supplies	$/t	5.0	5.13	5.25	5.38	5.52	5.66	5.80	5.94	6.09	6.24

Source: Citi Investment Research and Analysis

As Figure 113 and Figure 114 highlight, the cost of producing DRI (excluding the cost of iron ore) in the US is less than half of doing so in Europe.

Figure 113. US DRI Conversion Costs $/t

Total Costs		2011	2012E	2013E	2014E	2015E	2016E	2017E	2018E	2019E	2020E
Gas Costs	$/t	34.42	21.04	30.27	48.10	49.30	50.53	51.80	53.09	54.42	55.78
Electricity Costs	$/t	10.00	10.20	10.40	10.61	10.82	11.04	11.26	11.49	11.72	11.95
Labour costs	$/t	1.92	1.92	1.97	2.02	2.07	2.12	2.18	2.23	2.29	2.34
Maintenance Costs	$/t	5.00	5.13	5.25	5.38	5.52	5.66	5.80	5.94	6.09	6.24
Total Costs	**$/t**	**51.34**	**38.29**	**47.90**	**66.12**	**67.72**	**69.35**	**71.03**	**72.75**	**74.51**	**76.32**

Source: Citi Investment Research and Analysis

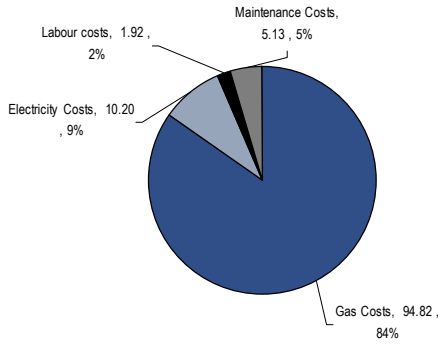
The differential between the cost of gas in the US and Europe means that the $/t difference in producing DRI can be $50-60/t.

Figure 114. EU DRI Conversion Costs $/t

Total Costs		2011	2012E	2013E	2014E	2015E	2016E	2017E	2018E	2019E	2020E
Gas Costs	$/t	94.82	94.82	94.82	94.82	97.19	99.62	102.11	104.67	107.28	109.97
Electricity Costs	$/t	10.00	10.20	10.40	10.61	10.82	11.04	11.26	11.49	11.72	11.95
Labour costs	$/t	1.92	1.92	1.97	2.02	2.07	2.12	2.18	2.23	2.29	2.34
Maintenance Costs	$/t	5.00	5.13	5.25	5.38	5.52	5.66	5.80	5.94	6.09	6.24
Total Costs	**$/t**	**111.75**	**112.07**	**112.45**	**112.84**	**115.61**	**118.44**	**121.35**	**124.33**	**127.38**	**130.50**

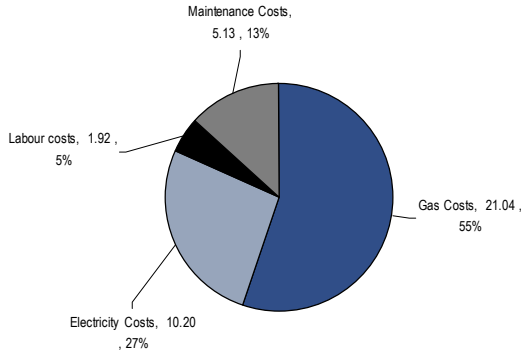
Source: Citi Investment Research and Analysis

Figure 115. European DRI cost breakdown



Source: Citi Investment Research and Analysis

Figure 116. US DRI Cost breakdown



Source: Citi Investment Research and Analysis

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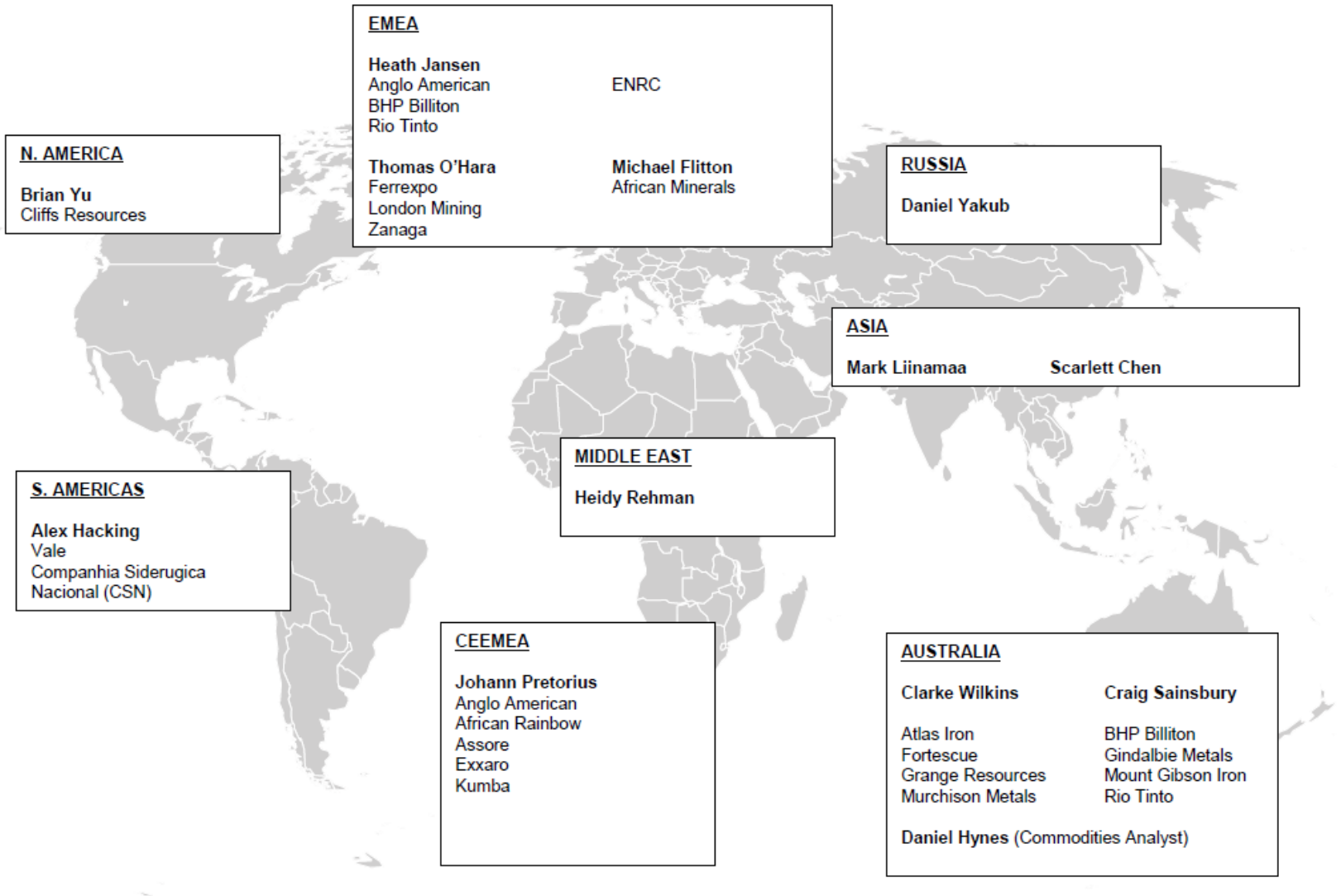
Appendix

Figure 117. CIRA Global Iron Ore coverage



Source: Citi Investment Research and Analysis

Regional Views

China – Scarlett Chen

Domestic ore production to continue expanding

China's domestic iron ore production has been growing since 2003. There are three main reasons for this: 1) Increasing steel production drives iron ore demand. 2) The government has promoted domestic production. Fixed Asset Investment (FAI) in the ferrous mining industry has grown at a 50%CAGR from 2003 to 2011. 3) High prices have incentivized local miners to extract ore, even for low grades.

Figure 118. China annual iron ore production

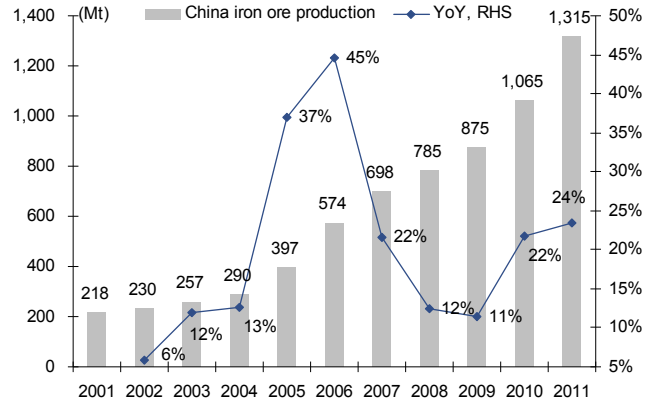
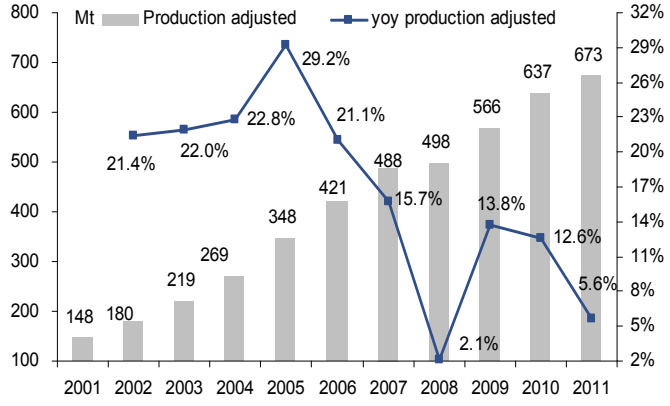


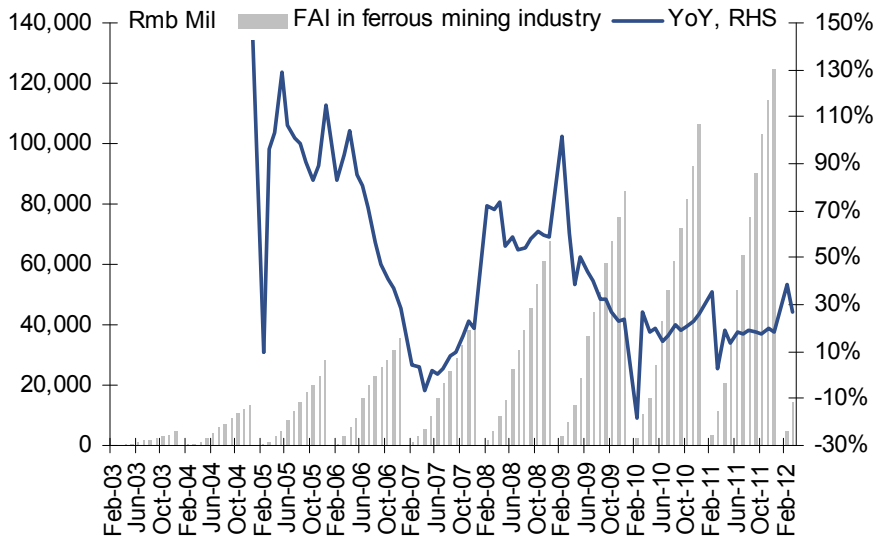
Figure 119. China crude steel production



Source: WIND, CEIC, Citi Investment Research and Analysis

FAI in ferrous mining industry recorded yoy growth of 26.6% in Jan-Mar 2012.

Figure 120. China FAI in ferrous mining industry

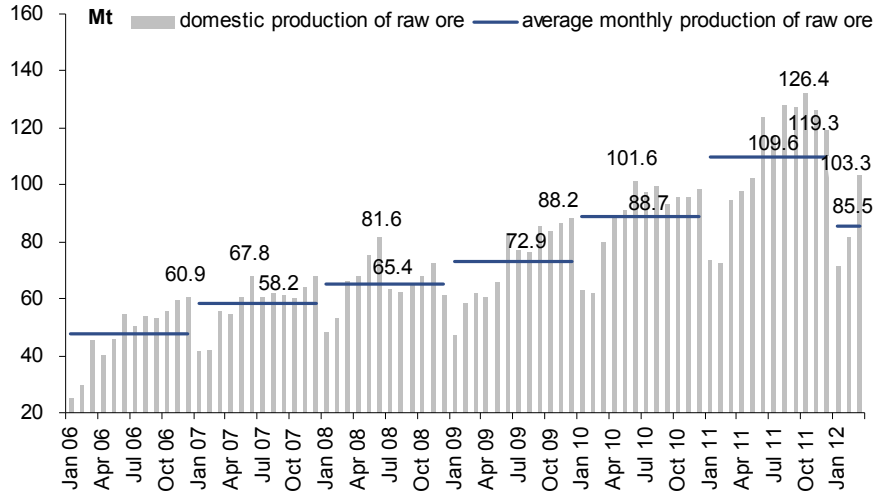


Source: WIND, Citi Investment Research and Analysis

Historical data suggests that monthly peak production recorded in the previous year more or less equals the monthly average in the current year. 2009 was an exceptional case, when import ore prices collapsed and China imported more to replace the high-cost domestic ore. Peak production recorded in 2011 was 126 Mt/month, annualized at 1.5Bt, which suggests a 24% increase yoy. However, 1Q12 production rose by only 6.5% yoy, softer than peak production suggested.

China 1Q12 iron ore production came to 256Mt, up by 6.5% yoy.

Figure 121. China monthly iron ore production

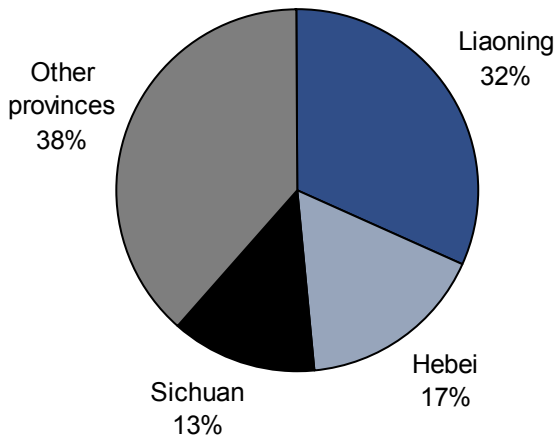


Source: WIND, Citi Investment Research and Analysis

China's iron ore production bases – Hebei, Liaoning, Sichuan

Approximately 61% of China's iron ore reserves were distributed in Liaoning, Hebei, and Sichuan in 2010.

Figure 122. China iron ore reserve distribution in 2010



Source: National Bureau of Statistics, WIND, Citi Investment Research and Analysis

These three provinces accounted for over 66% of China's total iron ore production in 2011. Hebei contributed 45%, followed by Liaoning 12% and Sichuan 10%. Over the past 5 years, their aggregate weight has expanded. The following may explain: 1. Hebei produced 24% (reported) of the crude steel in the country and has more than 300 mills operating in 2011.

2. Liaoning contributed 8% of the national steel production in 2011. The province is an old industrial base, which was founded by the Japanese during World War II. Liaoning retains mature technology in ore mining and beneficiation.

3. Sichuan, rich in vanadium-bearing iron ore resources, accounted for 10% of the national production of raw ore.

Figure 123. China iron ore production

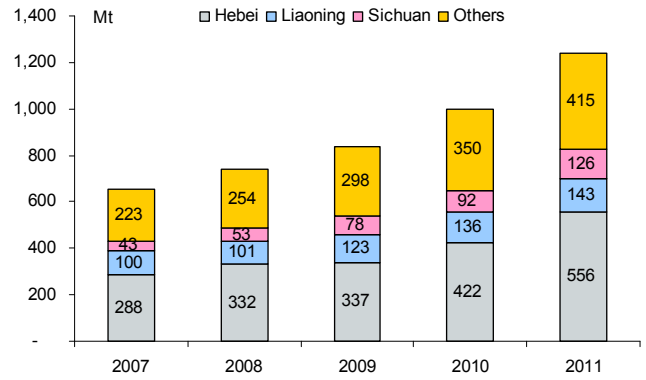
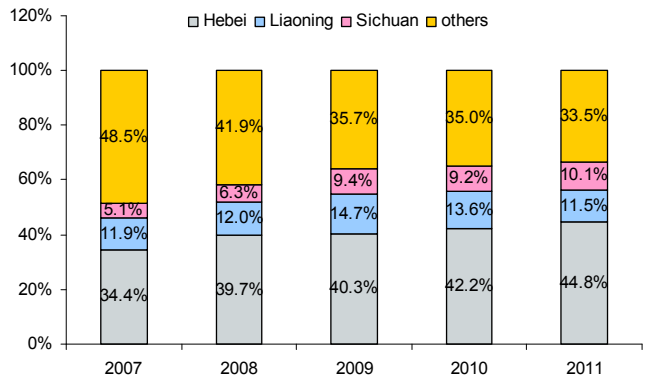


Figure 124. Major producing provinces - Hebei, Liaoning, Sichuan



Source: WIND, Citi Investment Research and Analysis

Iron ore imports forecast to fall 5% yoy in 2012

China imported 687Mt of iron ore in 2011, up 11% yoy. Meanwhile, domestic raw ore production grew 24% yoy. Having taken into account the deteriorating grade, domestic ore production equivalent to Fe63% fine ore amounted to 417 Mt, up 20.5% yoy. As a result, import reliance declined from 68% in 2009 to 62% in 2011.

Figure 125. China iron ore imports

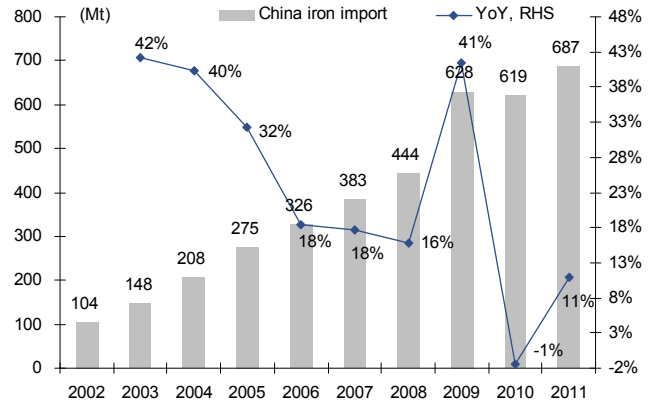
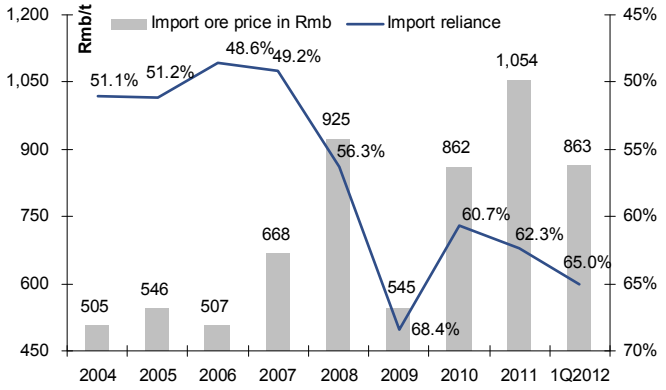


Figure 126. China iron ore import reliance



Source: WIND, Citi Investment Research and Analysis

In 1Q12, China imported 187Mt of ore, up 6% yoy, this was largely due to:

1) lower price
2) a hope for steel production to have reached a bottom
3) more liquidity

Figure 127. China iron ore import volumes

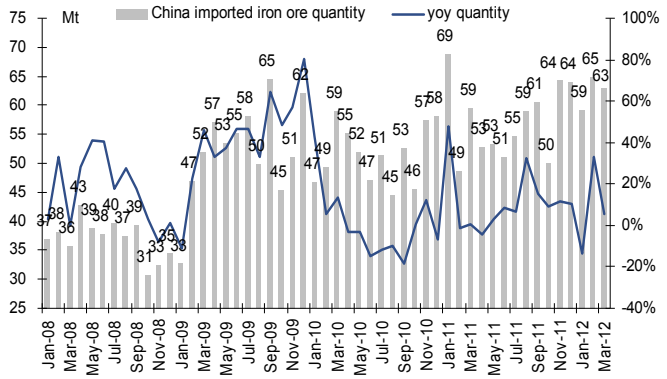


Figure 128. China average imported iron ore price

Source: Bloomberg, Citi Investment Research and Analysis

Iron ore price range bound between US$130-150/t

China's domestic iron ore price (Tangshan, excl.VAT) has dropped 20% from a peak of Rmb1,256/t in 4Q11 to the current Rmb1,000/t. Imported ore's spot price has also retreated from the 4Q11 peak of US$178.8/t to US$141.5/t at the beginning of the year, but rebounded to US$151/t in late April in line with upticking domestic steel production. Our channel checks suggest that domestic mills purchase at around US$130/t and stop buying at US$150/t.

Figure 129. Tangshan iron ore price

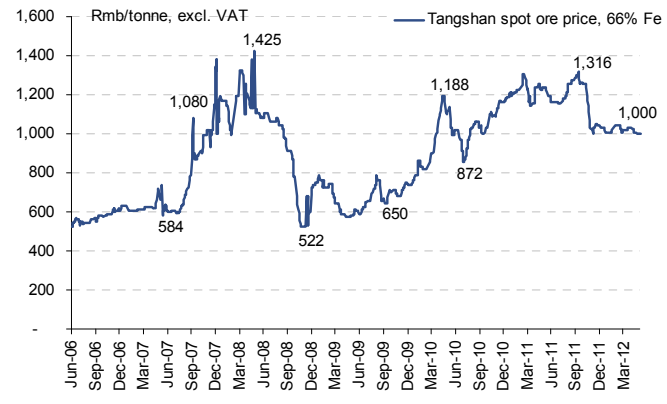
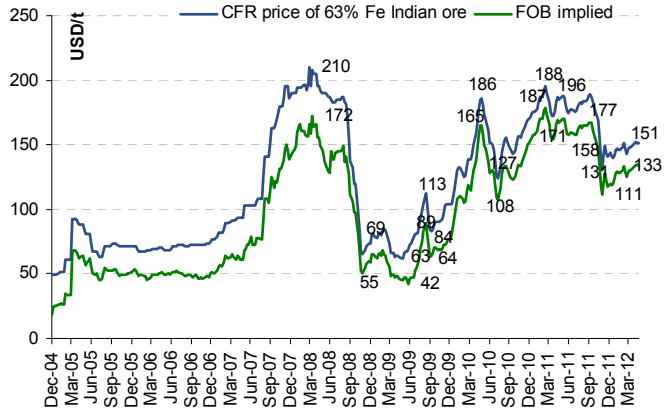


Figure 130. Imported iron ore price



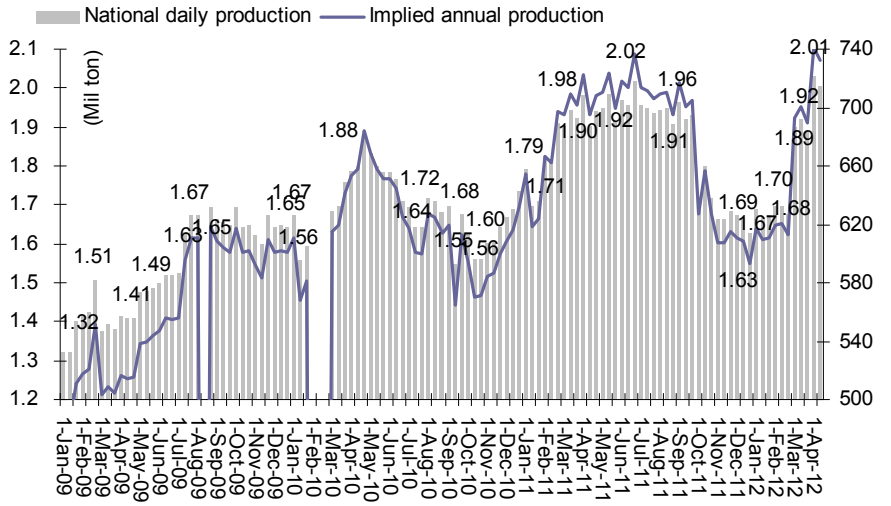
Source: Bloomberg, Citi Investment Research and Analysis

According to our channel checks, domestic producers' marginal cost of production is c.US$120/t or Rmb756/t, on a 63%Fe basis. We think the average cost ranges from Rmb400/t to Rmb500/t.

Domestic steel production has been climbing since late Feb, and reached 2.01Mt/day in mid-April, near the last historical peak in 2009 (2.02Mt/d in late Jun). The steel price has risen some 9% from the trough in mid-February to a recent high in April, and then eased. The spread gain of steel price vs. ore cost is diminishing. Most mills are making losses. We think steel production has more downside risk than upside risk.

Domestic steel production has been growing since late-February. It reached 2Mt/day in mid-April, close to historical high.

Figure 131. National daily crude steel production



Source: Industry authorities, Citi Investment Research and Analysis

Policy – resource tax discount narrowed since Feb 2012

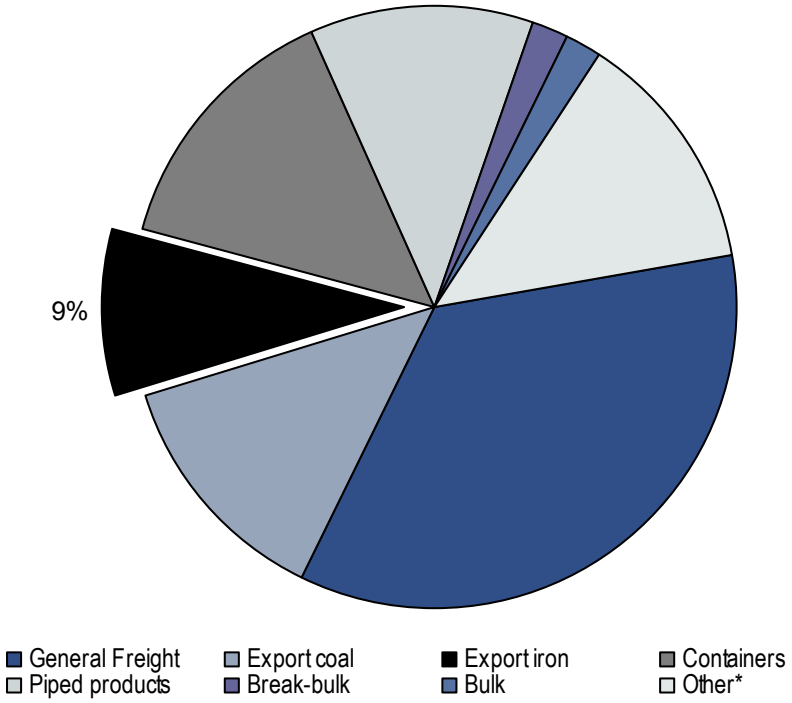
In February 2012, China's Ministry of Finance and the State Administration of Taxation announced it was adjusting the resource tax on iron ore. This was previously applied at a 40% discount to the provisional rate (Rmb11-23/t), but it was narrowed to 20%. We believe the effect on production cost is minimal, bearing in mind the total cost per ton of ore at 63%Fe ranges between Rmb400 and Rmb500. Assuming 3.5 tons of raw ore are required for 1 ton of fine ore, the cost addition is estimated as Rmb7.7/t to Rmb16.1/t.

South African – Johann Pretorius

Infrastructure bottlenecks – with any key port or rail expansions planned – expected delivery and any issues

- Transnet operates the iron ore export channel between Kumba and Assmang's Northern Cape mines to the Port of Saldanha. 2011 export capacity was 47Mt. Kumba exported 37Mt in 2011 and Assmang around 10Mt.
- Transnet is increasing port and rail capacity by 13Mt to 60mt to cater for Kumba's Kolomela expansion (+9Mt) and Assmang's Khumani expansion (+4Mt). Full 60Mt capacity should be available by July 2012.
- Future expansion up to 93 million tonnes by 2017 is being discussed between Transnet and the mining industry. This could mean an additional 20Mtpa in iron ore exports and potentially 13Mtpa allocated to manganese ore exports.

Figure 132. Transnet's investment directed towards major commodities over next five years



Source: Transnet 2011 operational review report, CIRA

Taxation / royalties / political issues

Effective tax rate of 40%

South African miners pay companies tax of 28% and iron ore miners pay royalties of around 5% on revenue. This implies an effective tax rate on EBIT of around 40% for iron ore miners.

Carbon tax

South Africa is looking to introduce a carbon tax from 2013 if a proposal contained in the country's latest budget comes to fruition.

The nation's Treasury department put forward a plan in early 2012 for a carbon tax of 120 rand (£10) per ton for emissions over and above a 60% threshold that will be set for a number of carbon-intensive sectors, including electricity, petroleum, iron, steel and aluminium.

As per the initial plans that will be published as draft policy later in 2012, the levy would increase by 10% a year until 2020. There is also a provision for all sectors expect electricity to claim additional relief of at least 10%.

Volume increases expected

Figure 133. Production and volume growth estimates from major iron ore producer in South Africa

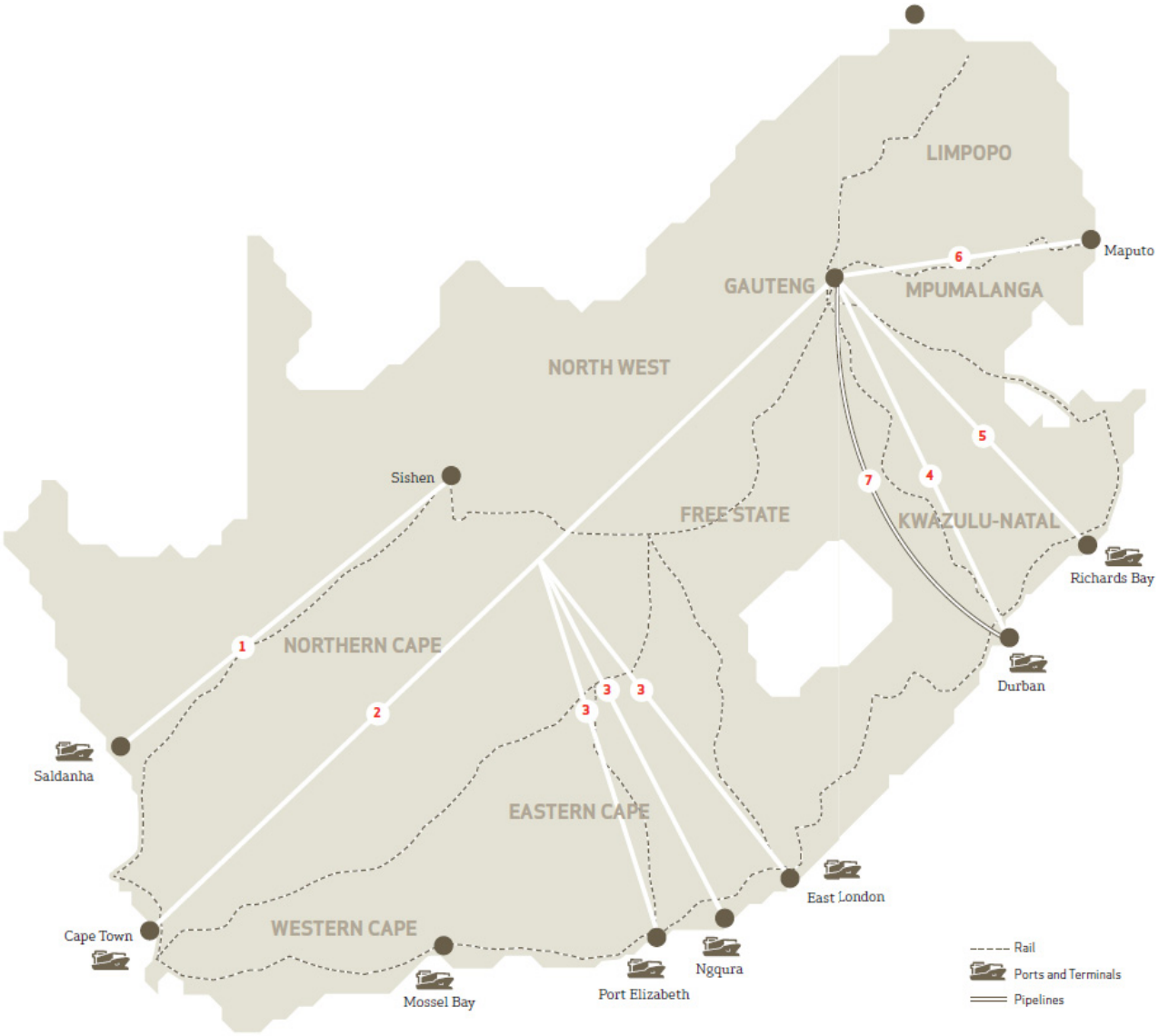
CY (000 tonnes)	2011	2012E	2013E	2014E	2015E	2016E	2011-16 CAGR
Kumba	42,868	47,000	52,800	52,300	51,800	54,590	5%
Assmang*	12,748	13,900	14,900	15,000	15,000	16,800	6%
Total	**55,616**	**60,900**	**67,700**	**67,300**	**66,800**	**71,390**	5%
% change		10%	11%	-1%	-1%	7%	

Source: Company reports, Citi Investment Research and Analysis, *Owned by African Rainbow Minerals and Assore

Domestic/regional issues

- While labour is still relatively cheap in South Africa, industrial action often affects miners' production and Transnet's performance.
- Like many other mining regions, South Africa faces a skills shortage.
- Increasing focus on mining safety by the South African DMR has led to several mine closures during 2011, which further affected productivity.
- Calls for nationalization of mines in 2011 caused investor concerns over security of tenure in South Africa. Although the nationalization debate has been silenced by government, higher taxes are still a probability.
- Delays in on-time arrival due to transit incidents such as theft and locomotive failure.
- Derailments. A single derailment caused 3.1 mt in export iron ore volume loss during 2011.
- High mining/transport inflation. Energy cost for Transnet increased 15.2% in 2011 due to higher fuel prices and significant increase in electricity tariff.
- Aging Transnet infrastructure resulted in increased maintenance requirements.

Figure 134. Five-year Capital Investment Plan: 2012–2016 in strategic corridors



Source: Transnet 2011 operational review report, CIRA

Figure 135. Transnet's investment in strategic corridors

Corridor	Primary commodities transported	Five-year capital investment R Bn
1 Sishen to Saldanha	Export iron ore	11.4
2 Capecor	General Freight	3.4
3 Southcor	Automotives, manganese and General Freight	3.1
4,7 Natcor	General Freight such as steel, domestic coal, containers and liquid bulk, Refined, synthetics, crude, avtur and gas.	31.1
5 R Baycor	Export coal, magnetite and chrome.	16.4
6 Maputo Corridor	General Freight	Included in National
8 National*	General Freight	39
	Other	6.2

Excludes capitalised borrowing costs.

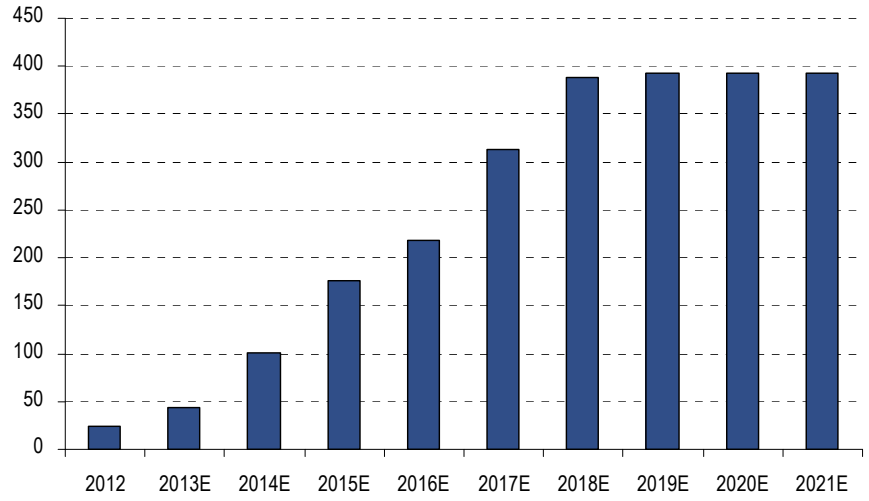
Source: Transnet 2011 operational review report, CIRA

West Africa – Mike Flitton, Tom O'Hara

There will be winners and losers

West African iron ore projects at varying stages of development could add over 350mt of capacity over the next decade. There are significant challenges to the successful ramp up of West African projects, before we even take into account whether global iron ore demand will warrant capacity additions of this magnitude.

Figure 136. Potential West African Supply



Source: Citi Investment Research and Analysis

Some generic risks applicable to the West African projects include:

Political instability, resource nationalism, untested mining codes all pose a risk

Country Risk – While many of the projects in the region tend to be in remote areas and therefore not necessarily affected by political upheaval, there have been instances over the last year of mines being disrupted by politics; Randgold's Tongon operations in Ivory Coast being notable. In addition, these projects will be operating under mining codes that are either completely untested or at best may lack the transparency and accountability of those in more established mining regions.

Many projects require significant investment in infrastructure to begin operating

Logistics – Infrastructure is generally poor in a lot of these regions and thus the projects will need to develop rail/pipeline and port facilities to access international markets. Certainly we look favourably upon those projects that are able, at least during early stages of the project, to 'piggy-back' on existing infrastructure, allowing a tiered and cash flow generative approach to full ramp up of the asset. A key example of this is African Minerals' Tonkolili mine, which uses existing rail and port infrastructure in Sierra Leone.

A weathered cap of ore for direct shipping, despite fetching a lower market price than concentrated project helps to get cash flowing

Ore quality – Many African projects are relatively low-grade magnetite, with varying degrees of impurities and thus require concentration and beneficiation, which also increases power/fuel requirements. Some projects do however include weathered caps which could result in directly shippable phases. Those projects with a layer of 'Direct Shipping Ore' (DSO), despite the ore achieving a lower price than a concentrated product, should be viewed favourably as it provides opportunity for the project to be cash flow generative while processing operations are still being built.

Funding and strategic support through stakes and/or offtake agreements can be a game changer

Funding and support – Many African projects are ambitious early-stage projects. In other words they carry greater risk than brownfield expansions in established iron ore regions such as the Australian Pilbara. Key to the success of an African project, perhaps more so than the actual quality of the deposit, will be securing the right funding and support. A project will be de-risked if it has a strategic partner on board with the financial muscle to commit to successful ramp up.

Who will win and who will lose?

In the interests of simplicity, we think the most likely winners in Africa will possess all or some of the following attributes:

1) **Strategic Partner on board** – A diversified mining company or an end user of iron ore with the experience/skills/financial muscle to push the project forward is in our view the most important attribute.

2) **Early Stage operational advantage** – being able to 'piggy-back' on existing infrastructure allows the mine to generate cash flow while ramp up takes place and thus de-risks the project from sinking the full capital commitment before operations can begin. A top layer of DSO will provide a similar advantage.

3) **Capital and operational efficiency** – The lower the cost of the project, the increasing likelihood of it being pushed forward. These projects are more likely to gain strategic backing and financing.

Australia – Clarke Wilkins

Growth Delivered, but at What Cost?

Australia has been able to significantly increase iron ore exports over the last 5 years driven by expansions from RIO, BHP and the entry of FMG into the market. There are numerous iron ore projects underway or planned that will drive a further significant increase in supply from Australia, but the key question going forward is not only how much supply can be delivered, but at what capex cost does it come.

Committed Expansions

There is no shortage of iron ore projects in Australia at the moment in construction, and also a number of new projects that still require financing/approval. This is not an exhaustive list, but covers most of the key projects and some hopefuls.

- **BHP Billiton** – Approval has already been made to expand managed capacity to 220mtpa, with further mine expansions and port debottlenecking expected to increase capacity to Port Hedland inner harbour allocation of 240mtpa by ~2015. BHP has also already committed US$917m for long lead time items for the outer harbour expansion that would increase capacity by 100mtpa, likely to be delivered in 2 x 50mtpa increments with first production in 2H16. The OH would give BHP further expansion options up to an ultimate Pilbara capacity of ~450mtpa.

- **Rio Tinto** – Pilbara managed capacity is now 230mtpa and expansions to 283mtpa are approved. The new port at Cape Lambert is expected to be expanded from 50mtpa to 100mtpa, and combined with further debottlenecking of infrastructure and new mine development, capacity is expected to increase to 353mtpa by 2016. Capacity of Cape Lambert could be increased by a further 100mtpa to match BHP's ~450mtpa of ultimate Pilbara capacity.

- **Fortescue** – capacity is 55mtpa and will be expanded to 155mtpa by mid-2013 (company target). Key projects are the expansion of existing Chichester operations (target completion Sept-Q 12) and development of a new 60mtpa mine at Solomon. FMG only has a port allocation of 120mtpa through Port Hedland and this is a potential constraint on it reaching the targeted 155mtpa – approval for the planned 5th berth still outstanding. Growth beyond this requires leveraging BHP's outer harbour development at Port Hedland or the proposed new port development at Anketell Point for development of FMG's Western Hub resources.

- **Hancock Prospecting - Roy Hill** – work has started on the greenfield 55mtpa mine in the Pilbara that will build a new ~340km railway and export through a new port facility in Port Hedland's inner harbour. Hancock Prospecting owns 70% of the project with other partners being POSCO (recently paid a net US$1.3b to increase stake from 5 to 12.5%), STX (US$332m for 5% in 2010), Marubeni (US$1.5b for 12.5% stake) and CSC (US$305m to acquire 2.5% stake from POSCO). Company now estimates capex at >US$9.5b, up from original estimates of ~US$8b.

- **Atlas** - Production is 6mtpa and an expansion to 12mtpa by end-13 is largely approved. Atlas has 46.5mtpa of inner harbour Port Hedland entitlement, but this next stage of growth requires access to rail (MOU to study new rail line with QR National recently signed) and North West Infrastructure (NWI) port development in conjunction with Brockman Resources Marillana project (total NWI port capacity 50mtpa).

- **Citic Pacific Sino Iron Project** – Production is due to commence in late 2012 with combined capacity of 27.6mtpa of pellets (6mtpa) and concentrate (21.6mtpa). The project has been delayed (first production target was originally 4Q10) and suffered several cost overruns (capex originally planned at <US$4b, now estimated at >US$6b, but could be higher). There is the potential to expand the capacity up to 75mtpa, but the aforementioned delays and cost overruns could put this in to date, or at the very least delay the delivery.

- **Gindalbie** – Gindalbie is developing the 10mtpa Karara mine in JV (50:50) with Ansteel. First production is targeted for Sept-Q 12, but we see potential for slippage. Karara has the potential to be expanded to 15-16mtpa using existing infrastructure, but growth beyond this to the ultimate target of 50mtpa will require the development of a new port at Oakajee that is looking increasingly unlikely given the economics of the Jack Hills and Weld Range (Sinosteel) projects that were the other foundation customers.

- **Asia Iron Extension Hill** – This project is a 10mtpa magnetite JV between Chongqing Chonggang Minerals Development and SINOM Investments and construction started in late-2011, with first production expected in 2014. Capex cost is estimated at US$3b, similar to the Karara project that is also in the Midwest region of Western Australia. Unlike Karara, the ore will be transported by slurry pipeline to Geraldton.

- **Mt Gibson** – production is running at ~5mtpa, but capacity will be 10mtpa once the bottlenecks at the Geraldton port allow full production from Tallering Peak and recently completed Extension Hill mine. Tallering Peak finishes in 2013 and Extension Hill in 2016 with Koolan Island going through to 2019 so mine life is an issue for the company.

- **Grange Resources** – In addition to the ~2.3mtpa pellet operation in Tasmania, Grange also owns 70% of the Southdown project magnetite near Albany, WA. A definitive feasibility study for this 10mtpa of magnetite concentrate project was recently completed and Grange is targeting first production in 2015.

- **Onesteel** – Currently exports 6mtpa (hematite lump and fines) from South Australia and is planning to increase to 11mtpa by mid-13. Onesteel acquired WPG Resources in 2011 and these projects form the main path for growth.

- **Cliffs Natural Resources** – Produce ~8.5mtpa from the Koolyanobbing mine near Kalgoorlie that is being expanded to 11mtpa. Material is exported through the Port of Esperance to the south. Also owns 50% of the 1.4mtpa Cockatoo Island operation that is near Mt Gibson's Koolan Island in the Kimberley, but will close in late-2012.

- **Mineral Resources** – Operates Carina iron ore project east of Perth near Cliff's Koolyanobbing mine that has recently begun exporting through Kwinana south of Perth. Capacity is 4mtpa.

- **IMX Resources** – Produces ~2mtpa from Cairn Hill project in South Australia. Only 4 years remaining, but also has the Mt Woods magnetite project.

- **Brockman Resources** – Marillana project is planned at 18.5mtpa and has critical port entitlement through NWI. Key hurdles are to put in place project financing, secure rail access and put in place port development partner. Wah Nam's bid for the company is still active (now owns almost 85% of Brockman).

- **Aquila Resources** – Aquila owns 50% of the West Pilbara Iron Ore project that is planning Stage 1 production of 30mtpa. Project requires a new ~250km rail line and port at Anketell Point. Company estimates capex at ~A$6b, but this estimate is from 2010 so is likely to increase. If the project was approved this year first production would be in 2015.

- **Golden West Resources** – Has a DSO resource (69mt reserve and 130mt resource) called Wiluna West that is looking to be exported through either Geraldton or Esperance. Distance from port imply it would likely require rail though and delays to Oakajee make this unlikely for a while.

- **Ironclad Mining - Witcherry Hill** – Initial 1mtpa DSO mine in South Australia due to start production in late-12, increasing to 2mtpa during 2013 through beneficiation plant. Medium-term target is 4-5mtpa through the development of the magnetite resource as well. Longer-term target of 10-12mtpa from the larger Hercules deposit 15km to the east (combination of hematite and magnetite).

- **Australasian Resources** – Balmoral South project that is adjacent to the Sino Iron ore project. Target is 24mtpa of magnetite concentrate, but project is at very early stage and looks unlikely to proceed.

Rising Capex Costs

One of the key issues facing projects in Australia at the moment is capex cost escalation. When looking at capex costs it is necessary to separate the hematite or direct ship ore (DSO) projects from the magnetite projects given different levels of capex intensity.

Figure 137. Capital Intensity of Australian Iron Ore Projects

Ore	Company	Project	Status	US$m	Capacity	US$/t
Magnetite	Gindalbie	Karara - with WC	Construction	3,000	10	300
	Gindalbie	Karara - 15mtpa	Construction	4,000	15	267
	Citic Pacific	Sino Iron	Construction	6,000	27.6	217
	Asia Iron	Extension Hill	Construction	3,000	10	300
	Grange	Southdown	Proposed	2,906	10	291
DSO	Fortescue	Chichester	Construction	3,000	40	75
	Fortescue	Solomon	Construction	5,400	60	90
	Atlas	6-12mtpa	Construction	672	6	112
	Mt Gibson	Extension Hill	Construction	130	3	43
	BHP Billiton	155-240mtpa	Construction	15,555	85	183
	Rio Tinto	220-353mtpa	Construction	20,615	133	155
	Hancock	Roy Hill	Construction	9,500	55	173
	BHP Billiton	Outer Harbour	Proposed	22,500	100	225
	Aquilla	West Pilbara	Proposed	6,000	30	200

Source: Company Reports and CIRA Estimates

Hematite

For the major Pilbara players the capex intensity of current projects varies from US$100/t for FMG to ~US$160/t for RIO and US$183/t for BHP.

Pilbara capex intensity varies significantly across projects at the moment driven by:

- When approved – capex continues to rise driven by labour cost pressures – domestic content is high (~70-80%) for these projects. BHP is later in the capex cost curve than RIO or FMG.
- Infrastructure – building new railway lines and ports can significantly increase the capex intensity. BHP has incurred significant capex to simplifying existing infrastructure that has been expanded gradually over the last 50 years. FMG's infrastructure is more modern and was planned to be expanded.

Not only is BHP's current capex higher than RIO, the capital intensity of the outer harbour is expected to be even higher. BHP claims that the capital intensity for Pilbara projects is now ~USS$200/t, excluding flagfall capex for things like dredging the outer harbour channel.

One of the key reasons why RIO has been able to deliver the expansion of the Cape Lambert port at a significantly lower capex cost than BHP is that it has been able to leverage the existing channel capacity – Cape Lambert capacity only ~80mtpa. For the Outer Harbour at Port Hedland BHP is required to dredge a new channel as the existing one is fully utilised by the inner harbour that has ~500mt of capacity allocated.

In addition to more dredging, BHP's jetty is ~4km long vs the 2km jetty required at Cape Lambert.

Magnetite

Magnetite projects are significantly more capex intensive driven by the additional infrastructure required at the mine to upgrade the lower grade ore to a 65-69% Fe magnetite concentrate.

Magnetite capex intensity typically is US$250-350/t depending on how much existing infrastructure is able to be utilised and whether any allowance is made for subsequent expansions. In addition to higher capex costs, operating costs are also typically higher at US$60-80 vs US$35-55/t for hematite/DSO projects.

Offsetting the higher capex and operating costs is the higher revenue as magnetite concentrate will typically get a 10% grade (~68% v 62% benchmark) premium and 10% quality (low impurities) premium relative to a benchmark fines product.

Operating Cost Pressures

Operating cost pressure continue to rise significantly in Australia due to a combination of A$ appreciation, labour cost escalation and cost of hiring and training the new workforce to meet the substantial increase in production.

In addition to these factors the iron ore producers have also been hit by the double whammy of:

- Royalties – Fines royalty in WA used to be below the lump royalty of 7.5%, but from FY13+ they will be the same – fines royalty was previously 5.625% and will increase to 6.5% in FY12 before increasing further to 7.5% in FY13+.
- MRRT – The Australian Federal Government has passed the Minerals Resource Rent Tax that has an effective tax rate of 22.5% after a number of deductions are allowed. Application of this tax is still uncertain due to the fair value allowance adjustment for the starting base allowance and deductions to the realised price to get back to the taxing point (at the ROM). Fortescue and a number of other miners have been open in saying that the liability is expected to be nominal in the first 5 years and this is certainly consistent with our forecasts, but the impact would be greater at higher commodity prices and/or once the starting asset base has been depreciated.

Rail Access

Given the distances of the mining operations from the coast, access to rail is critical for the economics of iron ore operations in Australia. Some operators, like Atlas and Mt Gibson, have been able to make trucking ore to the coast economic, but this generally requires that you are within 200km of the port, as beyond this the economics become marginal.

In the Pilbara, BHP and RIO have been successful at preventing their railroads from being declared open access through the courts, which means that new players either have to build new railway lines (FMG and Hancock) or negotiate for access for haulage (BC Iron). As the only real precedent for getting access to 3rd party rail we have is the BC Iron/FMG deal, where FMG now has 50% of the project in addition to charging ~$20/t for haulage and port fees, it is not surprising that Atlas is looking now at a JV with QR National to build a 4th railway line into Port Hedland that will be truly open access.

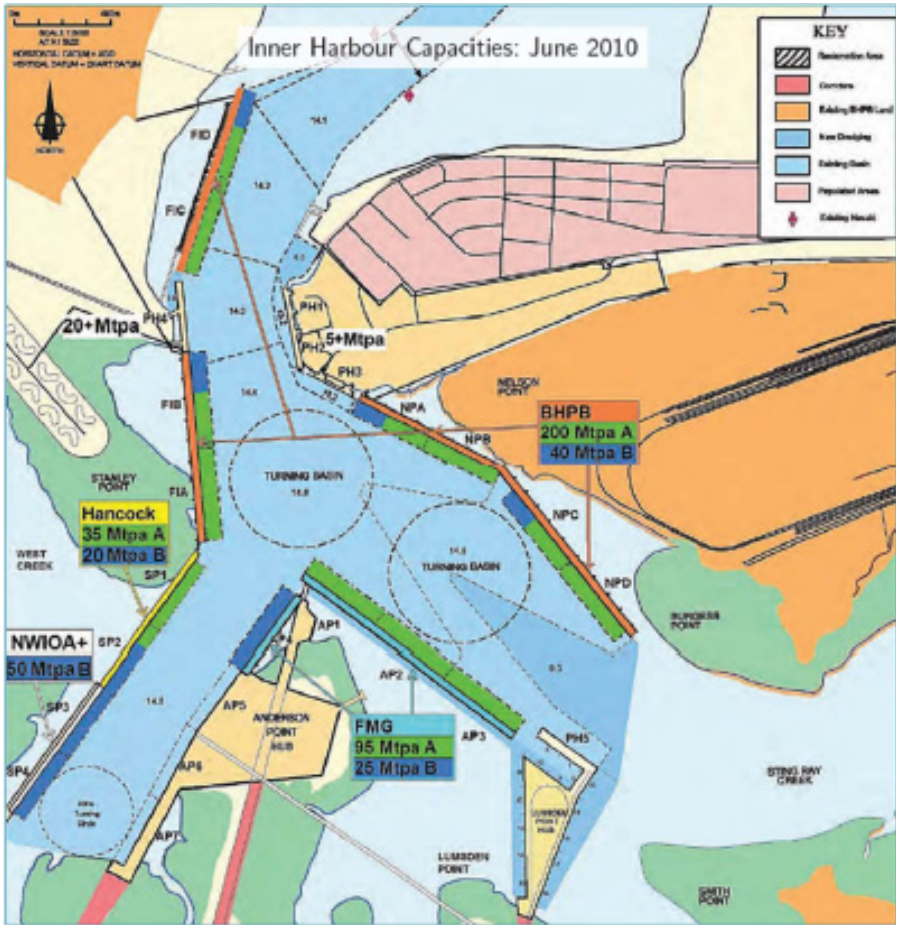
In the Midwest it is easier to access rail given the existing open access system, but due to the design of this railroad (narrow gauge) and competition with other users (grain), any significant capacity expansion in the Midwest will require development of the Oakajee Port and associated standard gauge rail network. Given the distance from the coast of these projects and the higher capital intensity of magnetite, we remain sceptical that this infrastructure will be developed.

Port Capacity

Port capacity is becoming more critical in Australia due to the high cost of constructing new facilities – dredging wharf construction and clearing environmental hurdles.

Port Hedland inner harbour capacity has been fully allocated with the only unused capacity to be constructed being the 50mtpa NWI allocation (Atlas and Brockman).

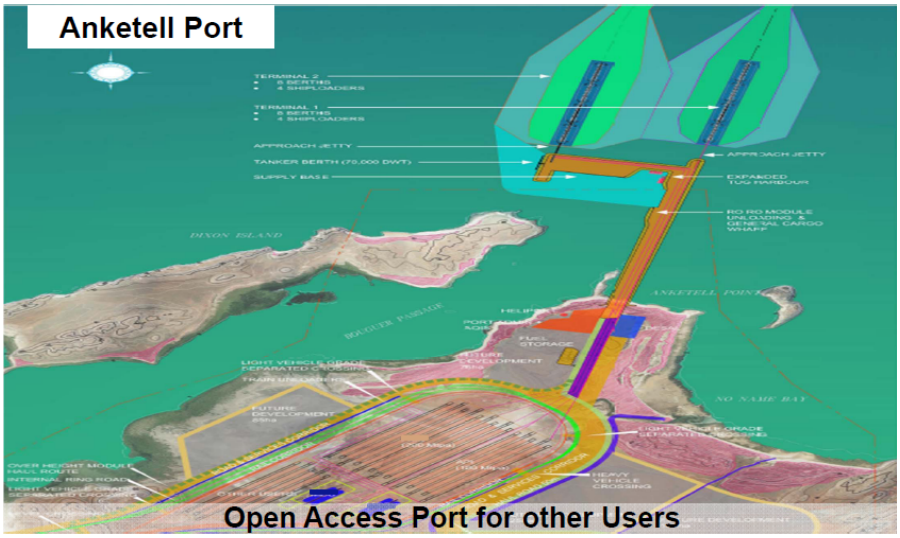
Figure 138. Port Hedland Allocation & Layout



Source: Company Reports

Anketell Point is the next major port facility that will be developed as a multi-user terminal, but construction has yet to commence as Aquila is the lead proponent and has yet to finance the project. As we saw with Oakajee, building new infrastructure to service multiple users is not easy to negotiate and finance. Fortescue was previously actively looking to utilise Anketell Point, but with the discovery at Nyidinghu near the rail line that already runs to Port Hedland, the potential to leverage BHP's Outer Harbour dredging could make this the more attractive option.

Figure 139. Anketell Point - Long-term 400mtpa Development



Source: Company Reports

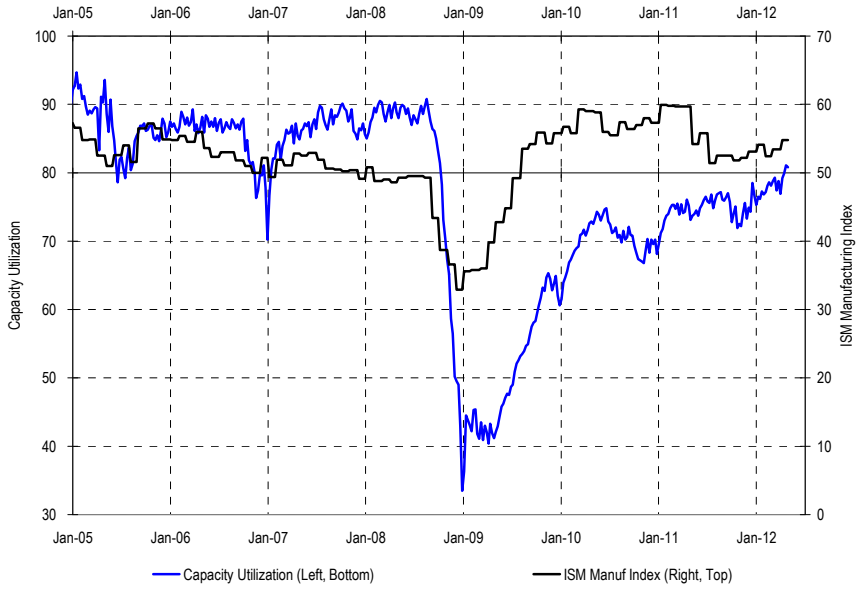
Americas

North America – Brian Yu

US largely remains a captive market of iron ore supply with 99% of annual output produced in Minnesota and Michigan and exports restricted by limited infrastructure capacity. Relative to 2011 production of roughly 54mn tonnes, Cliffs Natural Resources (CLF) is the largest merchant supplier at 24mn tonnes, but the company is only expected to mine 22mn tonnes for 2012 with the Empire mine curtailing operations to match an idled blast furnace.

However, overall US steel production and demand looks solid, despite the crucial construction spending still sitting at cyclical lows, and manufacturing activity remains supportive with the ISM PMI signaling growth. Steel mill utilization rates are bouncing around 79-81%, historically lower levels, but this also reflects increased capacity since the downturn. Weekly raw steel production tracks close to 2.0mn tonnes, roughly the same as the weekly average from 2004-07. Newer steelmaking facilities such as ThyssenKrupp's Calvert mill and Severstal's Columbus mill have displaced older facilities.

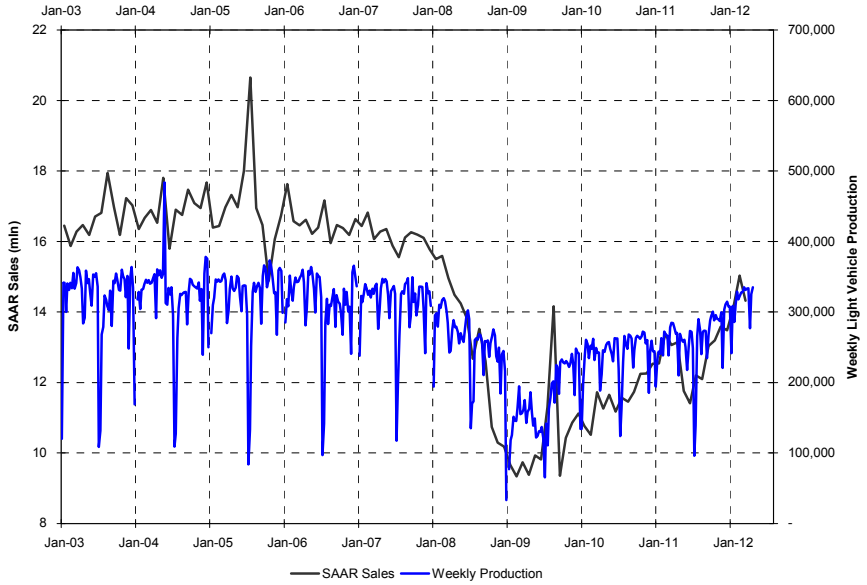
Figure 140. US Steel Mill Utilization and ISM PMI



Source: Citi Investment Research and Analysis

From our perspective, domestic steel demand is being driven by the automotive and machinery markets. While annualized vehicle sales of 14mn remain below historical highs of 16-17mn, light vehicle production has already recovered to historical norms because of increased transplant automakers. Should vehicle sales continue to improve, auto-related steel demand is likely to exceed prior cycle highs.

Figure 141. Weekly Auto Production vs SAAR Vehicle Sales



Source: Citi Investment Research and Analysis

The US is not a growth market for iron ore, but companies are trying to build captive capacity to lower costs. New permits however are difficult to secure as evidenced by Steel Dynamics' (STLD) ongoing effort to restart an idled mine so that it can use lower cost concentrate to feed its Mesabi Nugget project. As a stopgap measure, STLD has partnered with Magnetation to process iron ore tailings to produce concentrate, a 1.0mn tonne per year plant that is expected to begin production in 3Q12. Magnetation already has a 300k tonne plant #1 operating and plant #2 with 1.0mn tonne capacity should be running by June 2012.

In Canada, CLF is on target to achieve its planned 8mn-tonne nameplate production from its Bloom Lake mine in 2012 and construction of Phase II that adds another 8mn tonnes of capacity is 30% complete with engineering work 80% complete. All of the Bloom Lake concentrate is destined for Asia.

CLF is our favorite idea across our US coverage because of the company's iron ore exposure, discounted valuation, and high dividend yield of 4.3% that is well supported by our iron ore price forecast, free cash flow estimates, and growth projects in Canada.

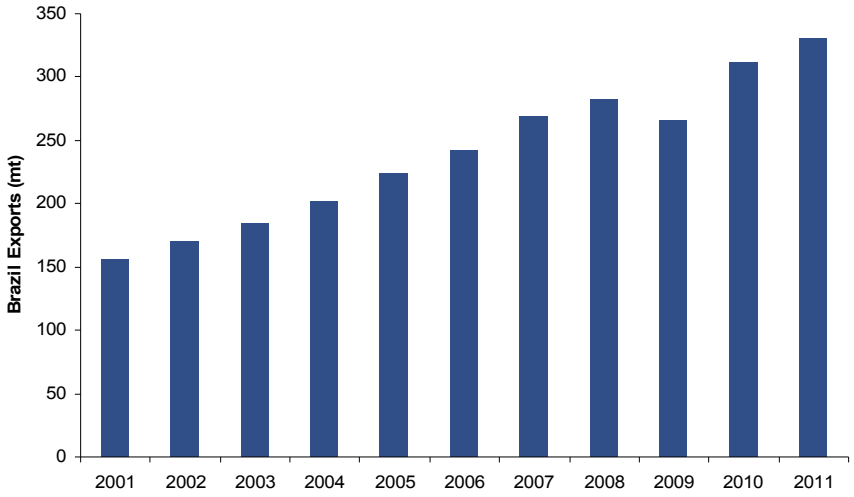
Latin America – Alex Hacking

Brazil

Brazil iron ore exports have grown at 8% CAGR in the past decade. This is a strong annualized rate over an entire decade – but results in recent years have lagged expectations.

The primary delay has been in securing necessary licenses and permits. The problem was exacerbated by lack of 3rd party export infrastructure. Vale still controls 90% of the export infrastructure in Brazil but new channels are expected to open up in the next 2-3 years (Minas Rio pipeline, MRS Rail-MMX Sudeste Port).

Figure 142. Brazil Iron Ore Exports (mt)



Source: Citi Investment Research and Analysis

The most likely sources of new Brazil iron ore supply in the next 4-5 years include:

- **Vale Carajás Serra Leste (6mtpy in 2013).** This project still needs an installation license. Engineering work is under way.
- **Anglo American Minas Rio (27mt in 2013).** The project has its main licenses. Multiple issues have caused historical delays, most recently over installation of power lines. But work is ongoing on the pipeline (40% complete) and at the mine (engineering works).
- **Vale Carajás +40 (40mtpy in 2014).** This project has the installation license for the mine, but not the rail upgrades. Engineering work in underway.
- **MMX Sudeste (24mt in 2014).** This project has the installation license for its beneficiation facility. Owner MMX is seeking project funding.
- **Usiminas (29mt in 2015).** This project is approximately one-year behind MMX. Funding maybe an issue with Usiminas earnings so weak.
- **CSN Casa De Pedra (+20mtpy in ??).** CSN has long talked of expanding Casa de Pedra but continues to delay the investment. Timing remains uncertain.

Note: Vale has multiple projects in the South of Brazil, but the company has not given full clarity if this will be additive to net-production, or just offset depletion.

Cumulatively these projects should add 100-125mtpy to Brazil export supply by 2016-17. Beyond these projects the critical expansion will be Vale Carajas Serra Sul:

- **Vale Carajás Serra Sul (90mtpy in 2017).** Serra Sul is Brazil's most important iron ore project. Vale is working on licensing and timing could be a risk. Serra Sul requires constructing a new mine in the southern range of Carajás, connecting this to the EFC rail via a new spur, double-tracking the existing EFC rail and expand Ponta do Madeira to accommodate this new volume.

Taxes

Iron ore taxes have become prominent in Brazil in the past 12 months because of high-profile legal cases related to Vale. There is still a relative degree of uncertainty, but we would categorize the main issues below:

- **National Mining Royalties.** Iron ore is assessed at 2% in Brazil. This is expected to be increased to 4% in Brazil's new mining bill to be presented in 2H12 or 1H13.
- **State Mining Royalties.** Para state and Minas Gerais state are attempting to levy mining royalties on iron ore. State level royalties have previously been declared unconstitutional by the Brazil courts. We expect the same result this time. Yet, this does highlight a national-regional conflict over allocation of mining taxes (which is an issue in Brazil and many other countries also).
- **State Mining Royalties.** Some state level politicians have been lobbying for a Special Participation Tax (SPT) in mining in the upcoming Brazil mining bill. Such a tax exists in oil & gas and taxes operating profits from 0-40% depending on scale. This measure is not believed to have support from President Dilma.
- **Legacy Taxes Disputes.** The Brazil Government has claimed that Vale, CSN and others owe money for underpayment of historical taxes. There are many components to these claims, but the largest relates to profits from foreign subsidiaries (which is partly driven by transfer pricing of iron ore). There are numerous legal challenges and we expect no immediate resolution.

Infrastructure

Rail/port capacity has been the main bottleneck to new iron ore supply from Brazil (as in the rest of the world). We expect iron ore channel capacity to increase from 390mtpy currently to 520mtpy by 2015E, primarily from Vale's CLN 150 expansion, the Minas Rio pipeline and MMX's new Sudeste project.

The main challenge to new infrastructure in Brazil is obtaining necessary licenses. This is especially difficult in Brazil considering the combination of government bureaucracy and highly diverse environmental ecosystems (inland and coastal).

There are 4 main operating export channels in Brazil:

- **Vale's Carajás rail (EFC) into Ponta do Madeira** ("Vale northern system")**.** Vale is expanding this channel to 150mtpy (CLN 150); and it will subsequently be upgraded to 240mtpy (CLN Serra Sul).
- **Vale's Vitoria-Minas rail (EFVM) into Ponta do Tubarão** ("Vale southeastern system").
- **MRS rail link into Sepetiba Bay in Rio de Janeiro state**. This is used by Vale's southern system and CSN. CSN is expanding its port from 30mtpy to 45mtpy (with talk of 60mtpy). MMX is opening a new 50mtpy port terminal which will be used by themselves and Usiminas (with talk of 100mtpy).
- **Samarco pipeline** into Ponta do Ubu.

Currently under-construction is one new channel:

- **Minas Rio pipeline** which will connect Anglo American's Minas Rio mine to LLX's new port Açu terminal in Rio state.

Figure 143. Brazil Iron Ore Export Channels: Operating and Under Construction

				Channel Capacity		
Export Channel	**Rail / Pipeline Link**	**Main Mines**	**Port**	**2012E**	**2015E**	**Future?**
Para to Madeira Port (MA)	Carajás Rail (Vale)	Vale Carajás	Madeira (Vale)	115	150	240
Minas Gerais to Tubarão Port (ES)	Vitoria-Minas Rail (Vale)	Vale Southeastern	Tubarão (Vale)	125	125	125
Minas Gerais to Sepetiba Bay (RJ)	MRS Rail (Joint*)	Vale Southern	Sepetiba (Vale), Guaíba (Vale)	95	95	95
"	"	CSN (CdP, Namisa)	Itaguai (CSN)	30	45	60?
"	"	MMX Sudeste, Usiminas Mendes	Sudeste (MMX)		50	100?
Minas Gerais to Ubu Port (ES)	Samarco Pipeline (Vale/BHP)		Ubu (Samarco)	25	25	25
Minas Gerais to Açu Port (RJ)	Minas Rio Pipeline (AAL)	Anglo Minas Rio	Açu (LLX)		30	60
Total				**390**	**520**	**705**
- Vale Tons				348	383	473
- Other Tons				43	138	233

Source: Citi Investment Research and Analysis

*MRS rail is owned 44% Vale, 27% CSN, 11% Usiminas 18% Other.

There are many other proposals for new channels but none under construction. These include:

- Meio Port Terminal. This will be a new port terminal in Sepetiba Bay (alongside Vale, CSN and MMX terminals). Brazil will hold an auction for this project.
- ENRC. Plans to use the new Leste-Oeste rail to connect mines in Bahia with a port terminal in Bahia.
- Ferrous Resources. Plans to build a pipeline to connect mines in Minas Gerais with a port terminal in Espírito Santo.
- Vetria. Plans to connect mines in the Corumbá region to Porto Santos in Sao Paulo state via an upgraded ALL rail link.

Figure 144. Vale Map of Key Operations in Brazil

Source: Vale Company Reports (2005 20-F)

India – Raashi Chopra

Overwhelmed By External Issues

The Indian iron ore industry, like its counterparts elsewhere, has enjoyed high levels of profitability due to a combination of low costs and strong pricing. These advantages have slowly been eroded over the past few years due to: 1) Constraints on output imposed by courts and state authorities; 2) Bottlenecks caused by insufficient or restricted transport capacity; 3) Slower clearances and insistence on value-addition to grant new mining leases; 4) Rising burden of duties and disproportionate freight costs for exported iron ore.

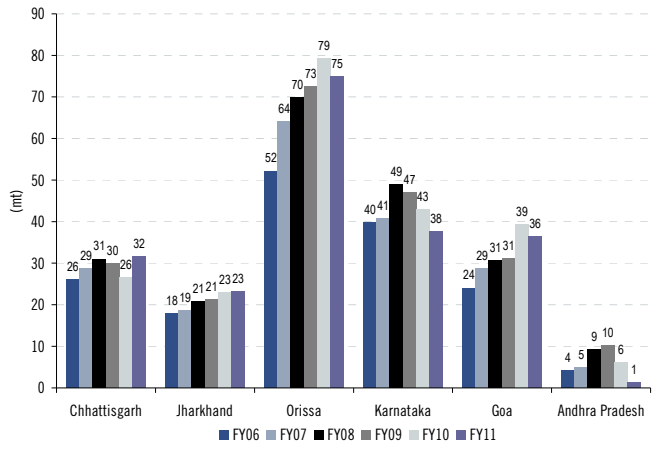
All this has led to a decline in production and exports since FY11 and the decline in both could continue for the next 2-3 years. India has comfortably produced well above its requirements and been a net exporter (50% of output exported in FY11). Even with constraints of output (which could get worse before they get better), India is unlikely to become a net importer of iron ore. The more likely outcomes are: 1) higher levels of beneficiation to use greater quantities of low grade ore domestically and 2) reduced steel output as imported iron ore would not be economical for most steel capacities. We discuss these issues and provide a background on the industry.

Declining Production/Exports

Iron ore production fell yoy in FY11 in the major producing states. Data for FY12 is not available yet.

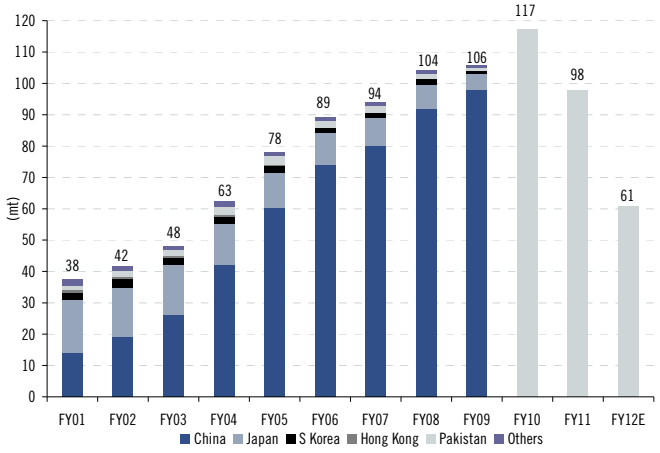
India produced ~208mt of iron ore (~70% with Fe content higher than 62%) in FY11 (year ended Mar11), 5% CAGR through FY06-11 and exported 98mt in FY11 (2% CAGR). We estimate exports have declined 38% to 61mt in FY12 (y/e Mar12). Production/exports have been on a decline since FY11:1) checks on illegal mining/ bans/curbs in Karnataka/Orissa/Goa; 2) transportation/logistic bottlenecks; 3) High duties/freight; 4) Slow clearances; 5) Weather issues.

Figure 145. Statewide iron ore production in India (mt)



Source: Ministry of Mines, IBM, Citi Investment Research and Analysis

Figure 146. India iron ore exports FY01-12E (mt)



Source: Ministry of Mines, IBM, FIMI, Citi Investment Research and Analysis estimates

Output Constraints

The iron ore industry has faced increasing levels of restrictions either imposed by state governments, or imposed by court orders and in addition to mining have also affected the movement of iron ore. The restrictions have affected Karnataka the most, but are causing problems in Goa and spreading to Orissa. Output has also been affected by an increasing insistence on value-addition by state governments before granting new mining leases. We examine this in the section below.

Karnataka

■ Iron ore export ban

There have been no exports out of Karnataka since July10.

The Karnataka Government had banned the export of iron ore out of Karnataka with effect from 29 July 2010, in an attempt to curb illegal mining. Karnataka accounted for ~25-30mt of India's total exports prior to the ban.

The Supreme Court passed an order to lift the ban on iron ore shipments from Karnataka wef from 20 April 2011 with new rules to check illegal mining. However, despite the Supreme Court's order, exports had not resumed due to delays in setting up storage/transport infrastructure as per the state's new mining law. Subsequently, a blanket ban was imposed on iron ore mining in Karnataka by the SC during July-Aug11 due to widespread environmental degradation. Hence there have been no exports out of Karnataka since July10.

■ Blanket ban on iron ore mining

We think iron production out of Karnataka is likely to resume in FY13. While difficult to quantify the amount, we do not believe ore mined out of Karnataka, will exceed 12-13mt in FY13.

Karnataka's iron ore production in FY11 was 38mt (-13% yoy), 18% of India's production. The SC issued a blanket ban on iron ore mining in Karnataka in July-Aug11 (except NMDC) with a view to check illegal mining on reports by the Central Empowered Committee (CEC) of widespread environmental degradation in the state. However, it permitted the domestic sale of 25mt inventory via an e-auction process and permitted the sale of NMDC's iron ore in Karnataka via e-auction so that steel production could continue in Karnataka.

The SC in April 2012 allowed the restart of mining and accepted the following CEC recommendations: 1) Cap iron ore mining in Karnataka at 30mt; 2) Iron ore to be sold via e-auction conducted by the Monitoring Committee appointed by the SC; 3) Exports allowed only with respect to the ore not purchased in the auction.

Sources indicate that the CEC has classified the 166 mines in Karnataka into three categories: 1) Category 'A' - 45 legal mines (of these 19 are working leases); 2) Category 'B' - 72 mines - illegal mining to the extent of 10% outside lease area; 3) Category 'C' – 49 leases - illegal mining beyond 10%.

Media/industry sources indicate Category A mines should start mining in 2-4months and the annualized ore output from these is estimated at 10-12mt in addition to 5-7mt from NMDC.

Goa

We do not believe a blanket ban on iron ore exports out of Goa will be imposed. With most of Goa's ore being exported and mining contributing to 35% of the state's GDP, a more likely scenario is a cap on iron ore mining and exports out of Goa.

Goa accounted for 18% of India's production (37mt) in FY11. Ore from Goa is largely low grade, below 62% Fe and most of it is exported out of India (45-50% of India's exports). The mining industry accounts for ~35% of Goa's GDP.

The Shah Commission has been appointed by the Ministry of Mines to probe into illegal mining. The commission's report on illegal mining in Goa was submitted to the Central Government in March12. According to the report, mining beyond permissible limits was carried out in Goa causing environmental degradation and more than half the mines committed illegalities on various counts.

The commission has recommended a blanket ban on iron ore exports out of Goa and out of India.

Orissa

Media reports (Economic Times) indicate the Government of Orissa may cap iron ore mining at ~50mt (vs 75mt in FY11).

Exports out of Orissa are ~14-15mt; curbs/cap on mining in Orissa could impact export volumes.

Orissa accounted for 36% of India's iron ore production in FY11 (75mt). The Shah Commission has raised concerns over illegal mining in Orissa and the extraction of ore in excess of the approved mining plan. It has recommended a curb on iron ore production.

Some of the issues cited by the commission are: 1) lack of enforcement of mining rules; 2) Tata Steel's Joda East iron ore mines being allowed to operate in a deemed manner since 2005 since the expiry of the lease period; 3) Mines of Essel company operating without having permanent forest clearance.

Logistic constraints

According to the Goa Mineral Ore Exporters' Association, exports through the Panjim and Mormugao ports fell 15% yoy to 38mt during FY12, which could have been somewhat higher, but for the road and clearance constraints.

Shortage of adequate road/rail capacity is a problem across the Indian mining sector. This results in producers limiting output at times despite having clearances. Not only is there a shortage of rakes, but there is a shortage of line capacity – particularly in Orissa. Some states have restrictions on the timing of the movement of trucks carrying ore. For example, in Goa, ore can be moved for 9 hours/day (Monday to Saturday).

Slow clearances

Obtaining necessary clearances takes anywhere between 2 to 7 years. Going forward mining leases may not be granted without value-addition as states are reluctant to grant new mining leases to standalone mines.

The weight of higher costs

The high levels of profitability have attracted rising levies by various government arms in India and this has partly been driven by the steel industry chorus to restrict iron ore exports. Various levies such as higher royalties, export duties and disproportionately higher rail freight have all led to reducing competiveness for Indian iron ore. The draft Mining Bill could make things worse.

Higher royalties

Change in royalties

Royalties were changed from a flat rate to ad-valorem in Aug09.

According to the provisions of the MMDR Act 1957, the Central government can enhance or reduce royalties with respect to minerals provided it does not enhance the rate of royalty on any mineral more than once during in three years. The last revision with respect to iron ore royalties took place in Aug09 when it was increased from a flat rate of Rs11-27/t to 10% ad-valorem based on the price determined by the Indian Bureau of Mines (current royalty ~Rs250-300/t). A royalty revision is expected in CY2012.

Draft Mining Bill

An amount equal to 100% of royalties is proposed to be paid to the local population.

Separately, the Draft Mines and Minerals Development and Regulation (MMDR) Bill, 2011 has recommended a sum equivalent to royalty in case of major minerals (other than coal) is to be shared with the local population. The royalty amount would go to the State and the other amount that would go to the District Mineral Foundation. These are statutory payments and no offset would be granted to corporates against their existing CSR expenses. The Bill, if passed in its current form, would affect margins. NMDC, India's largest domestic iron ore producer, however, passes on royalties to its end consumers.

Higher export duty

The steel industry has been lobbying for a ban on iron exports and export duty has been rising progressively. Duty on fines has moved from zero in Dec08 to 30% in Jan12.

Figure 3. Export Duty Regime - A Changing Landscape

Feb-07	Specific export duty on all ore grades
Jun-08	15% ad-valorem duty on all ore grades
Oct-08	Rs200/t on fines; 15% ad-valorem duty on lumps
Nov-08	8% ad-valorem duty on fines; 15% ad-valorem duty on lumps
Dec-08	No duty on fines; 5% ad-valorem duty on lumps
Dec-09	5% ad-valorem duty on fines; 10% ad-valorem duty on lumps
Apr-10	5% ad-valorem duty on fines; 15% ad-valorem duty on lumps
Feb-11	20% ad-valorem duty on fines; 20% ad-valorem duty on lumps
Jan-12	30% ad-valorem duty on fines; 30% ad-valorem duty on lumps

Source: Citi Investment Research and Analysis

Higher export freight

Rail freight for iron ore exports is high at $50/t (cut ~16% in March12); almost 3x that of domestic freight.

India Unlikely to Import

India has traditionally exported substantial quantities of iron ore. This is expected to fall due to the production/export constraints detailed above. However, iron ore imports are unlikely, as there is no expectation of a shortfall and in any case would be uneconomical. Exports would likely fall further and beneficiation capacity would likely increase to use larger quantities of low grade ore domestically.

Exports out of India are likely to be ~55mt in FY13 and ~50mt in FY14.

We expect steel production in India to be 82mt in FY13 (iron ore required is ~132mt) and 90mt in FY14 (iron ore required ~144mt). Iron ore production in FY11 was 208mt. Thus the impact of bans/curbs would have to be more 76mt in FY13 and 64mt in FY14 vs FY11 for India to become an importer which is not likely.

Currently ~70% of India's ore produced is >62% Fe. More likely outcomes of bans/curbs on iron ore production are:

- Lower exports
- More beneficiation capacity being set up
- Lower-than-expected steel production

Exports fell 17% in FY11 to 98mt and 38% in FY12 to 61mt (estimated). We believe with Karnataka unlikely to resume exports on a significant scale, logistical constraints in Goa, and illegal mining checks in Goa and Orissa, exports out of India are likely to be ~55mt in FY13 and ~50mt in FY14.

Figure 147. Monthly iron ore exports from India (mt)

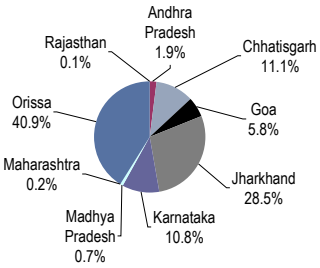
	FY11	FY12E	FY13E	FY14E
April	11.4	8.1		
May	11.5	9.3		
June	5.0	4.1		
July	4.7	3.6		
August	4.7	2.7		
September	3.0	2.9		
October	6.9	4.5		
November	8.3	4.7		
December	9.7	6.0		
January	10.7	5.5		
February	10.1	4.2		
March	12.2	5E		
Total	**98.2**	**60.7**	**55**	**50**

Source: Federation of India Mineral Industries, Citi Investment Research and Analysis

About the Indian iron ore industry

India has one of the world's largest iron ore reserves estimated at 7bn tonnes. India produced ~208mt of iron ore (~70% with Fe content higher than 62%) in FY11 (year ended Mar11), 5% CAGR through FY06-11 and exported 98mt in FY11 (2% CAGR). Exports are estimated to have declined 38% to 61mt in FY12 (y/e Mar12). Around 50% of India's iron ore production is consumed domestically (assuming no export ban). India is an exporter of iron ore and does not import ore (some quantities of pellets imported).

Figure 148. FY10 – State wise reserves



Source: Ministry of Mines, IBM, FIMI

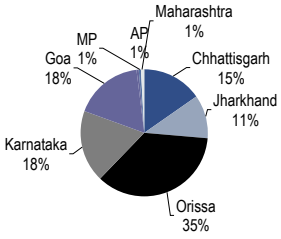
Figure 149. Indian Iron Ore Production and Value (annually)

Year	Iron ore production (m tonnes)	Value (Rs bn)
2004-05	145.9	74.0
2005-06	165.2	108.0
2006-07	187.7	142.0
2007-08	213.2	233.8
2008-09	213.0	285.4
2009-10	218.6	268.6
2010-11	208.0	375.3

Source: Ministry of Mines Annual Report 2010-11, Figures for 2009-10 are provisional and for 2010-11 are estimated. Note 2010-11 implies year ended March11.

Most of India's iron ore production (>95%) is in the states of Orissa, Karnataka, Chhattisgarh, Goa and Jharkhand. ~25-30% of India's production is from public sector companies such as NMDC and SAIL. Balance is from the private sector including companies such as Tata Steel.

Figure 150. FY11 – State wise production



Source: Ministry of Mines, IBM, FIMI

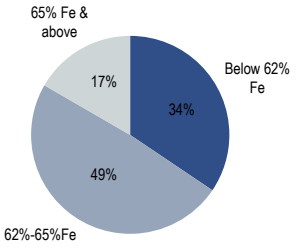
Fines account for 55-60% of India's iron ore production and the balance is in the form of lumps. The domestic industry consumes around 90% of the lumps produced and a large proportion of fines are exported. Of the total iron ore produced (in FY10), ~25% is greater than 65% Fe grade, ~46% is between 62-65% Fe and the balance 29% less than 62%.

Figure 151. India's lumps and fines production breakdown

Particulars	FY06	FY07	FY08	FY09	FY10(P)
Lumps	41%	47%	46%	43%	42%
Fines	57%	52%	54%	56%	58%
Concentrates	3%	1%	0%	0%	0%

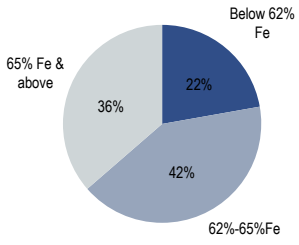
Source: Federation of India Mineral Industries, Indian Bureau of Mines. Note: FY11 data not yet available.

Figure 152. Fines breakup – grade wise (FY10)



Source: Indian Bureau of Mines

Figure 153. Lumps breakup – grade wise (FY10)



Source: Indian Bureau of Mines

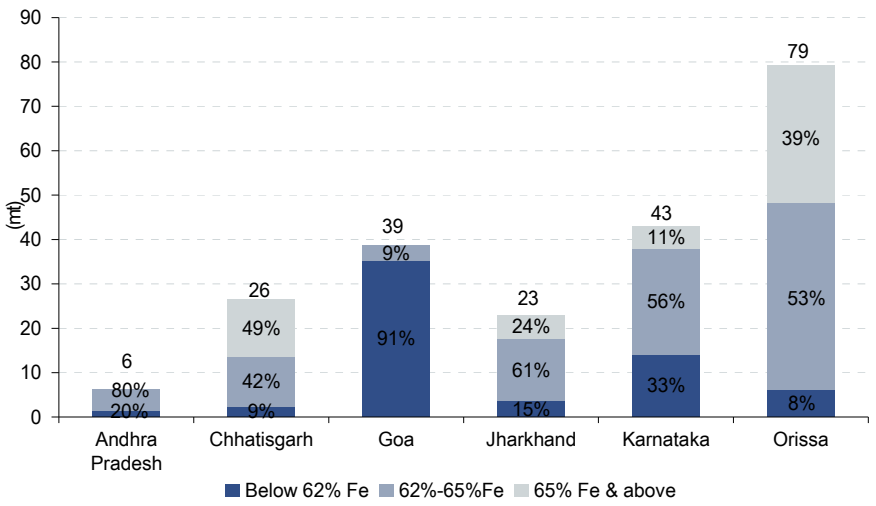
Orissa is India's largest iron ore producer with 60% of production having Fe content in excess of 62%.

Karnataka is the second largest iron ore producer in India with 67% volumes having Fe content greater than 62%.

Goa is India's third largest ore producer with low grade ore largely exported.

>50% of India's iron ore production is exported and around 80-85% of India's exports are in the form of fines. China is India's biggest market and accounts for >85% of India's exports.

Figure 154. Statewide production and grade break up (FY10 production)



Source: Citi Investment Research and Analysis

Pricing of iron ore

Current price (Apr-Jun12) for fines have been fixed at Rs2,600/t ($53) and for lumps at Rs5,400/t ($102). This compares to derived import parity prices of ~$40/t for fines.

NMDC is India's largest domestic iron ore supplier. The prices to be charged from long-term customers last year were determined by deducting from the FOB value of exports – the expected railway freight; royalty, export duty and port charges. This method of pricing is now only used as a reference check by the company and NMDC now prices its ore based on the e-auction market in Orissa, Karnataka and data points collected from the Joint Plant Committee (JPC is officially empowered by the Ministry of Steel / Government of India to collect data on the Indian iron and steel industry).

Cost of iron ore in India

Indian ore is cost competitive, but infrastructure constraints have led to higher transport costs in India.

Iron ore mined in India has traditionally been low cost, particularly relative to that mined in China. However, due to a lack of dedicated rail infrastructure and capacity constraints for railway networks and ports, transportation costs are higher in India as compared to both Australia and Brazil. Iron ore mining in India is carried out by the open cast method and large mechanized mines are mostly in the public sector.

Indian supply (typically a major source for China) continues to move up the cost curve given higher export duties (30% duty) and internal transport costs and post the recent increase in duties is most likely above Chinese domestic costs (thought to be ~ $115/t at the higher end of the curve).

Figure 155. FOB cost of Indian iron ore ($/t)

Mode of transport (mine to port)	Rail	River
Cost of mining	12	12
Royalty @ 10% of ex-mine price	5	5
Export duty @ 30%	45	45
Mine to port freight	50	6
Port charges	3	3
Total FOB cost of Indian iron ore	115	71

Source: Citi Investment Research and Analysis

Map showing major Indian iron ore mines

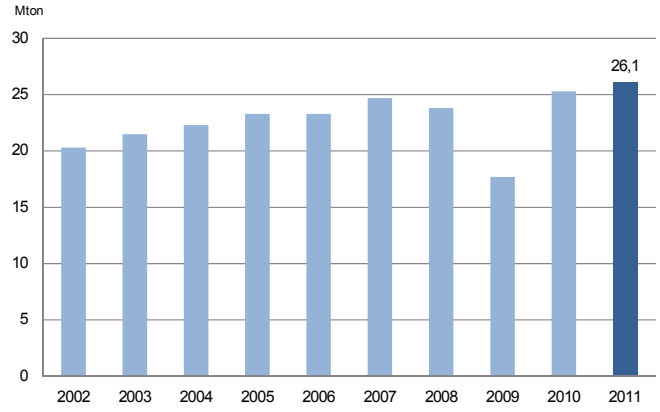
Figure 156. India Iron Ore Mines

Source: Maps of India, Citi Investment Research and Analysis.

Europe – Tom O'Hara

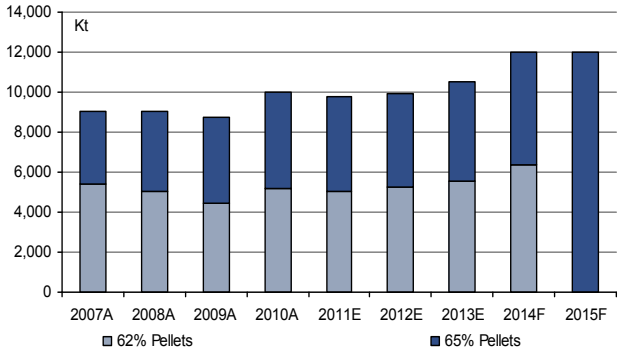
The two major exporters in Europe are LKAB a Swedish state owned company, which produces around 26Mt of pellets per annum, and Ferrexpo from Ukraine which produces around 10Mt of pellets per annum.

Figure 157. LKAB – production of pellets



Source: LKAB, Citi Investment Research and Analysis

Figure 158. Ferrexpo pellet production



Source: Citi Investment Research and Analysis

Ferrexpo

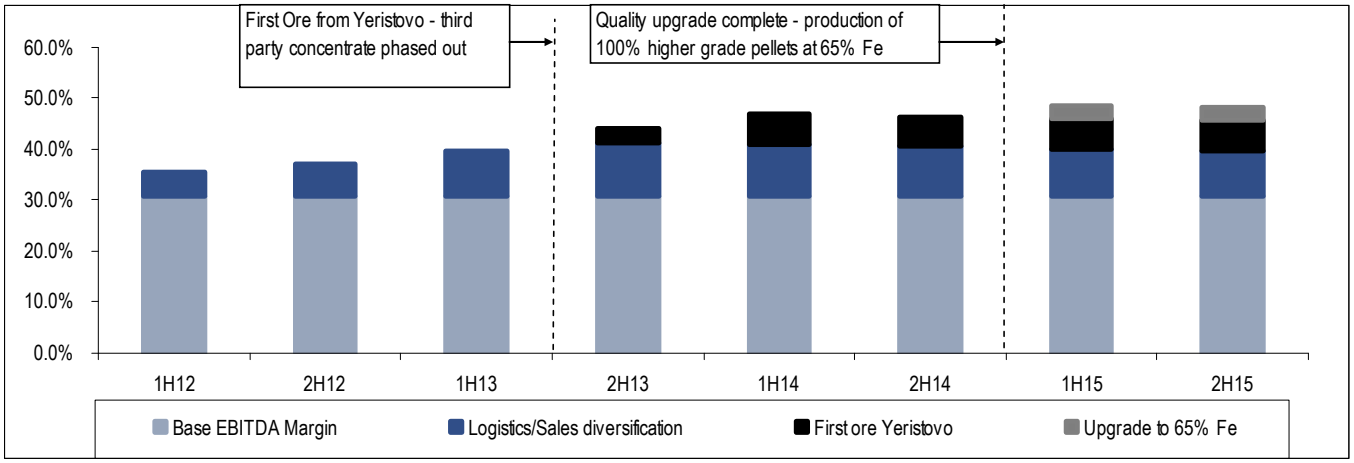
Ferrexpo produces around 10mt of pellets each year, with a roughly 50/50 mix of lower quality 62% Fe pellets and higher grade 65% pellets. It has traditionally served local markets in Central and Eastern Europe – Voestalpine is one of its largest customers – though is now making a push for Asian markets; in 2011 Asian shipments increased to 40% from 23% in 2010.

Alpha to play for

Ferrexpo has traditionally underachieved on pricing compared to international pellet premiums, due to its more localised customer base. It is attempting to rectify this through the diversification of its customer base. As mentioned above, 40% of sales now go to Asia, shipped through TIS Ruda port on the Black Sea, of which FXPO owns 50%. Further infrastructure investments are being made to improve the company's global reach; capesize vessels are being loaded at TIS Ruda (thus saving on freight costs) and it also purchased barging company Helogistics which ships on the Danube River, in order to further penetrate the Western European markets.

Ferrexpo is also focussing on improving its product offering by upgrading its current facilities so that all pellets produced will be higher grade with 65% Fe content. This initiative is running alongside expansion to 12mt through the development of the Yeristovo mine, which during phase 2, should see the company reach 20mtpa. Important to note however, is that the company is first optimising its current operations and maximising its achieved price before pursuing significant volume growth. We think these optimisation initiatives will add ~10% to EBITDA margins.

Figure 159. Ferrexpo Estimated EBITDA margin contribution from phase 1 initiatives – at constant iron ore prices



Source: Citi Investment Research and Analysis

Expansion Project Details

Carajas+40 (Brazil) – Vale

Carajas +40 is a brownfield project being developed in the northern range of Carajas in Para state. The project also includes infrastructure upgrades on the Carajas rail road and Ponta do Madeira port.

Total budget is US$6.5bn, $3.0bn for the mine and $3.5bn for logistics. The project is targeted for 2H13, with accompanying logistics to be completed in 1H14. The project received a construction license in early-2012.

Figure 160. Crajas+40 project location

Source: Company Presentation

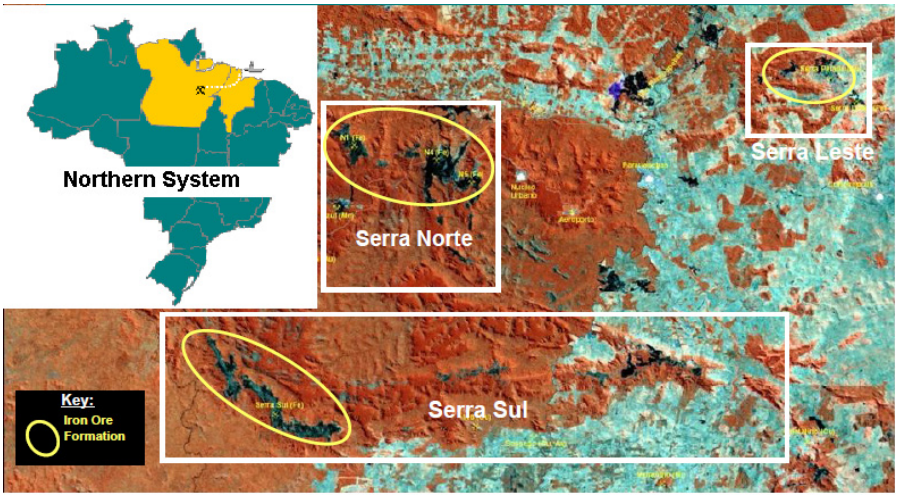
Carajas Serra Sul (Brazil) - Vale

Serra Sul mine is a quasi-greenfield project opening up the Southern range at Vale Carajas. S11D is the single largest known deposit in Carajas. An open pit mine and a beneficiation complex will be constructed with an annual capacity of 90 Mtpy using a truckless mining operation. The project also includes adding capacity to the Carajas railroad and expanding Ponta do Madeira port.

Total budget is US$19bn, $8bn for the mine and $11bn for logistics. The project is targeted for 2H16, with accompanying logistics to be completed in 1H17. The project is expected to receive a preliminary license in 2012, and a construction licence in 2013.

The main licensing challenge will be issues related to water and also the presence of archaeologically-important caves in the area.

Figure 161. Carajas Serra Sul project location



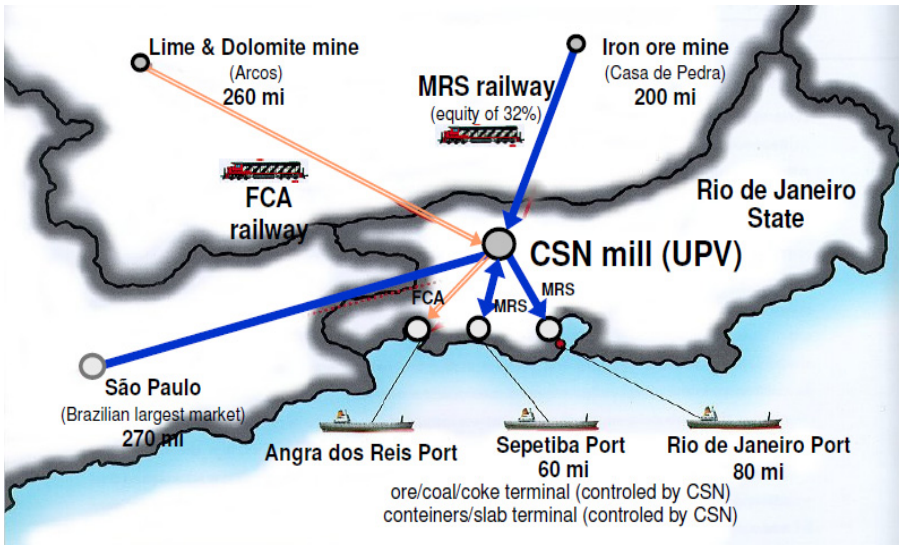
Source: Company presentation

Casa de Pedra (Brazil) - CSN

Casa de Pedra is a brownfield project aiming to expand production from 20mtpy to 50mtpy. The mine is located in Minas Gerais, Brazil. Expected cost is $4.5bn, which also includes cost of upgrading port infrastructure to 45mt (and possibly 60mt). The project has access to MRS railway network which is 32% owned by CSN and wholly owned Itaguia port facility located at 250km from mine.

Progress at the project has been slower than expected, with little capital committed during 2011. Expansion at Casa de Pedra may also be limited by local opposition from the town of Congonas.

Figure 162. Casa de Pedra project location



Source: Company Presentation

Serra Azul (Brazil) - MMX

MMX Serra Azul is a quasi-greenfield project targeting 24mtpy of installed capacity by 2014 (from 8mt today). The mine is in Minas Gerais, Brazil. The project will be the first compact itabirite project in Brazil. This material is harder and lower-grade than traditional Brazilian itabirites. The harder nature requires extra beneficiation steps - increasing capex and opex. The end product is typically too granular for sintering and is sold as pelletizing concentrate.

The Serra Azul project also includes a port in Rio de Janeiro state (Sudeste port) connected to the mine by the MRS railroad. The port project is under construction and fully funded. MMX has negotiated a long-term price with MRS. The mine project is awaiting debt financing and recently received its installation license for the beneficiation facility. Capex for Serra Azul is indicated at $3.5bn.

Figure 163. MMX Sudeste Project Location

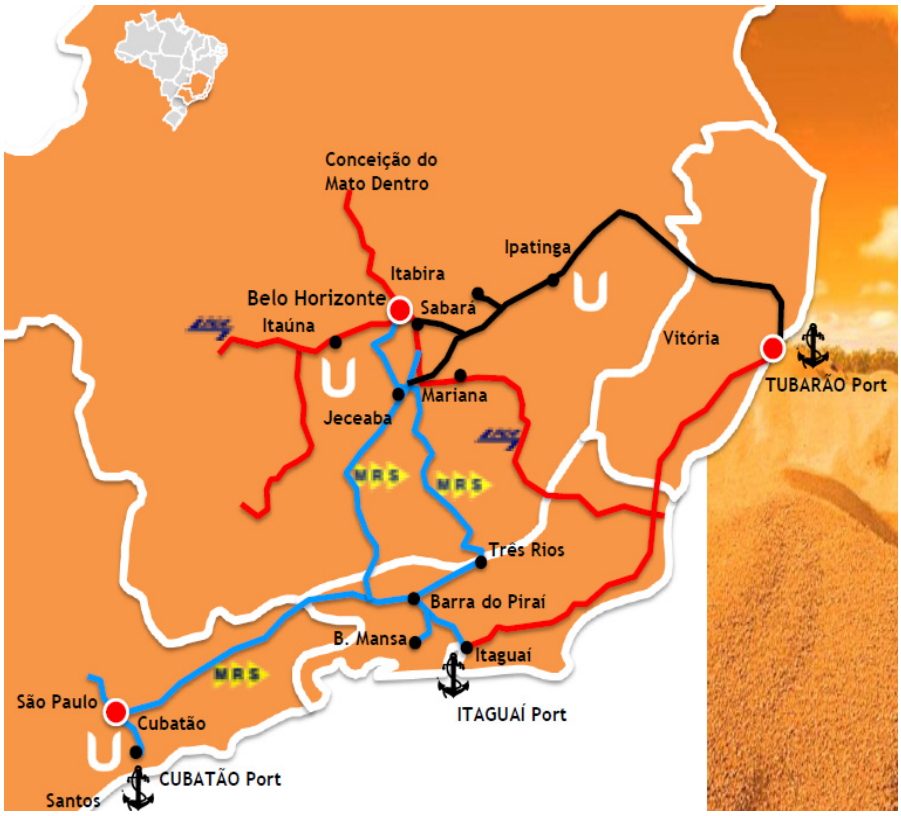
Source: Company Presentation

Mineração Usiminas (Brazil) - Usiminas

Usiminas acquired four mining sites from J. Mendes Group in 2008 located in the Serra Azul area to form mining division Mineração Usiminas. The company sold a 30% stake to Sumitomo. The project aims for 29mt of iron ore capacity by 2015 (from 8mt today). Ore will be shipped on the MRS rail (in which Usiminas is a shareholder) and shipped from Rio de Janeiro state. Usiminas will use MMX's Sudeste port at first, but may opt to construct its own facility at some point.

Usiminas project is a compact itabirite project, similar to MMX Serra Azul. Total budget for the project is US$2.5bn. Usiminas earnings are weak and the project is under review by Usiminas new controlling shareholders.

Figure 164. Serra Azul mining area



Source: Usiminas corporate presentation

Fortescue – Chichester and Solomon (Australia)

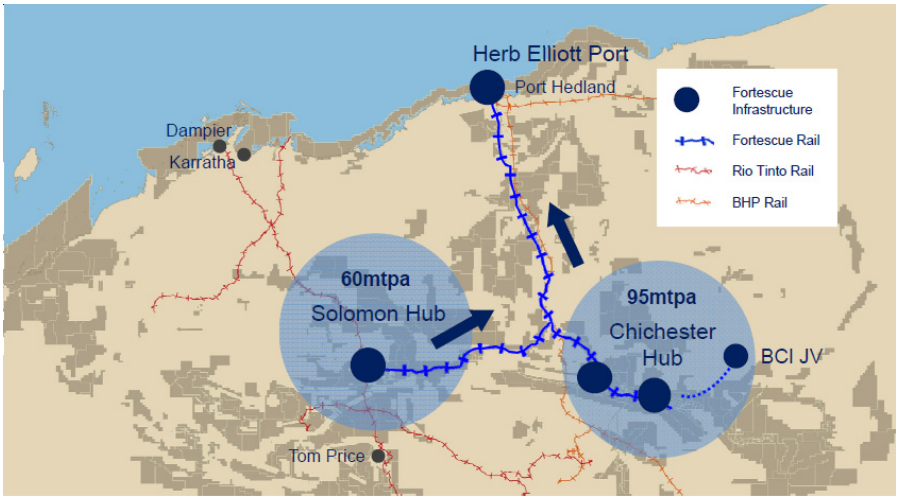
FMG is simultaneously expanding the existing Chichester mines (Cloud Break and Christmas Creek) from 55 to 95mtpa and also developing a new 60mtpa mine at Solomon, to the west of the existing mines.

Total capex for the project is US$10b, broken down to US$6.5b for infrastructure, US$1.4b for mine fleet and US$2.1b for other costs.

The capex cost can be further broken down to US$1.1b for the expansion of the Chichester mining hub, US$2.7b for the new Solomon mine, US$2.2b for rail upgrades and US$2.4b for the port.

First production from the expanded Chichester Hub in Sept-Q 2012, with Solomon ramping up from June-Q 13.

Figure 165. Solomon Project Location



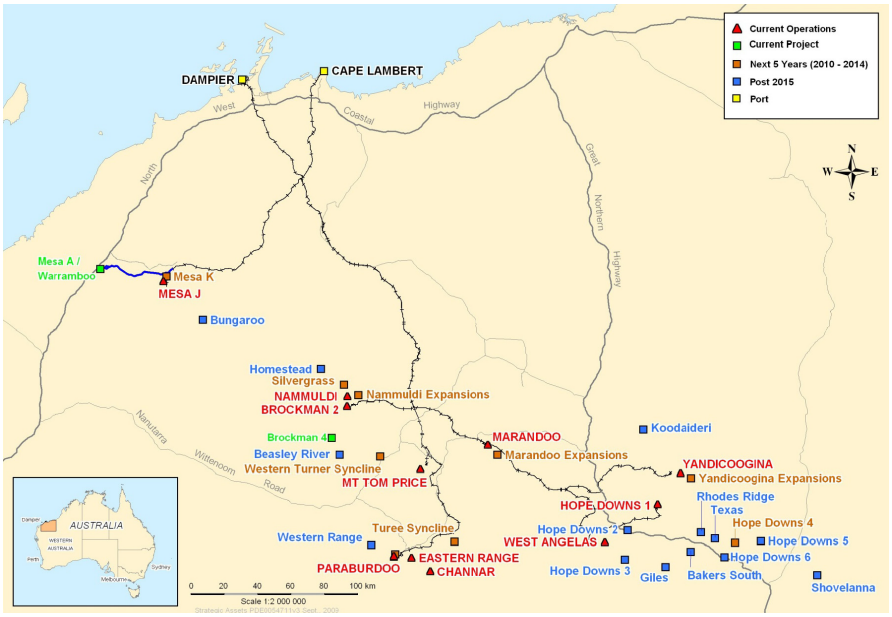
Source: Company Presentation

Cape Lambert expansion (Australia)

Rio Tinto is expanding its managed Pilbara capacity from 220mtpa to 353mtpa driven by new port facilities adjacent to the existing port at Cape Lambert (Robe). In addition to the new 100mtpa port, replacement of an aging car dumper will also increase the existing capacity by a further 20mtpa at Cape Lambert.

Total capital cost for the expansion is expected to be US$20b or ~US$155/t. Phase I for 53 mtpa has been approved for implementation while phase II for additional 50 mtpa is expected to be approved later this year.

Figure 166. Rio Tinto expansion project location



Source: Company presentation

BHP WAIO Inner Harbour (Australia)

BHP Billiton has various projects underway that will expand capacity at the WA Iron Ore operations to inner harbour port allocation of 240mtpa. Projects approved to date will take capacity to 220mtpa, but final approvals for the additional mine expansions and infrastructure debottlenecking will be approved in 2012.

Approved capex for the projects still in construction is ~US$8.6b, but total capex to expand production from 155mtpa to 240mtpa is expected to be ~US$183/t or US$15.5b, excluding capex to optimize the business.

Figure 167. RGP6 Project Location

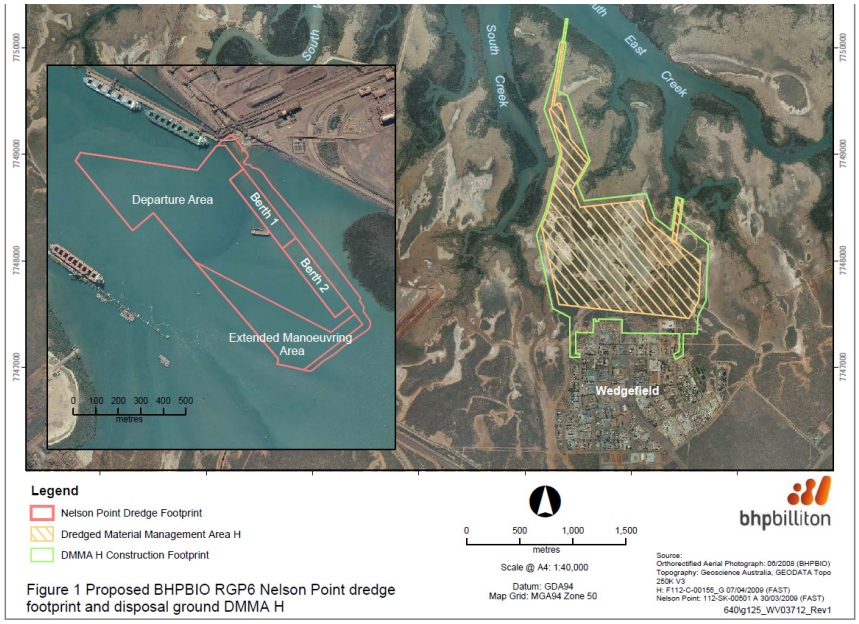


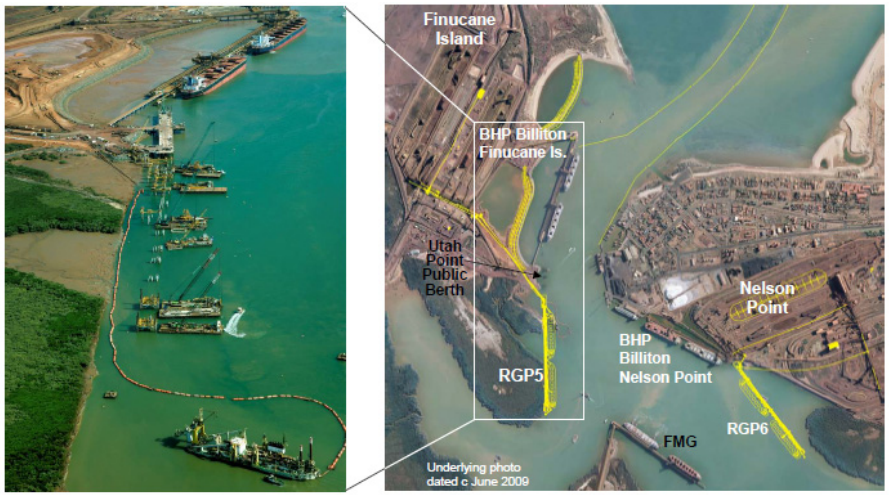
Figure 1 Proposed BHPBIO RGP6 Nelson Point dredge footprint and disposal ground DMMA H

Source: Company Presentation

RGP5 (Australia)

RGP5 is part of massive phased expansion being carried out by BHP Billiton, which started with Mining Area C, followed by the production and capacity expansion project and Rapid Growth Projects (RGPs) 1,2,3, and 4. This 50mtpa project is located in the Pilbara region in Western Australia.

Figure 168. RGP5 Project Location



Source: Company Presentation

MMX Sudeste (Brazil)

MMX Sudeste is developing two projects - Serra Azul and Bom Sucesso - both 100% owned by the company. The new Serra Azul plant will have 24mtpy of installed capacity while Bom Sucesso will have ~10mtpy capacity. Capex for Serra Azul is indicated at $3,548m and for Bom Sucesso at $1,467m. Bom Successo is indicated to produce 67.2%Fe with ~30% magnetite content.

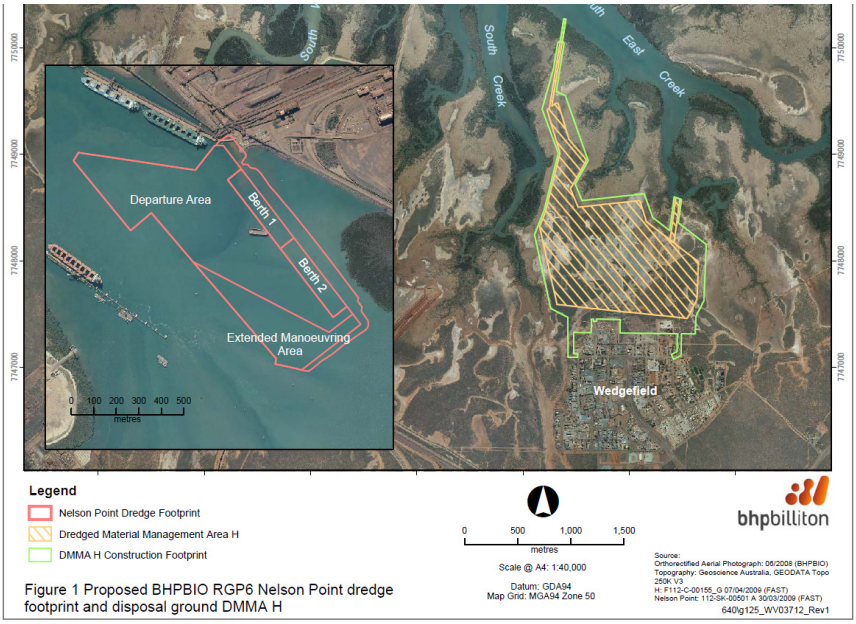
Figure 169. MMX Sudeste Project Location

Source: Company Presentation

RGP6 (Australia)

RGP6 is a part of massive phased expansion being carried out by BHP which started with Mining Area C, followed by the production and capacity expansion project and Rapid Growth Projects (RGPs) 1,2,3, 4 and 5. This 35mtpa project, located in the Pilbara region in Western Australia is the last of the current expansion programme.

Figure 170. RGP6 Project Location

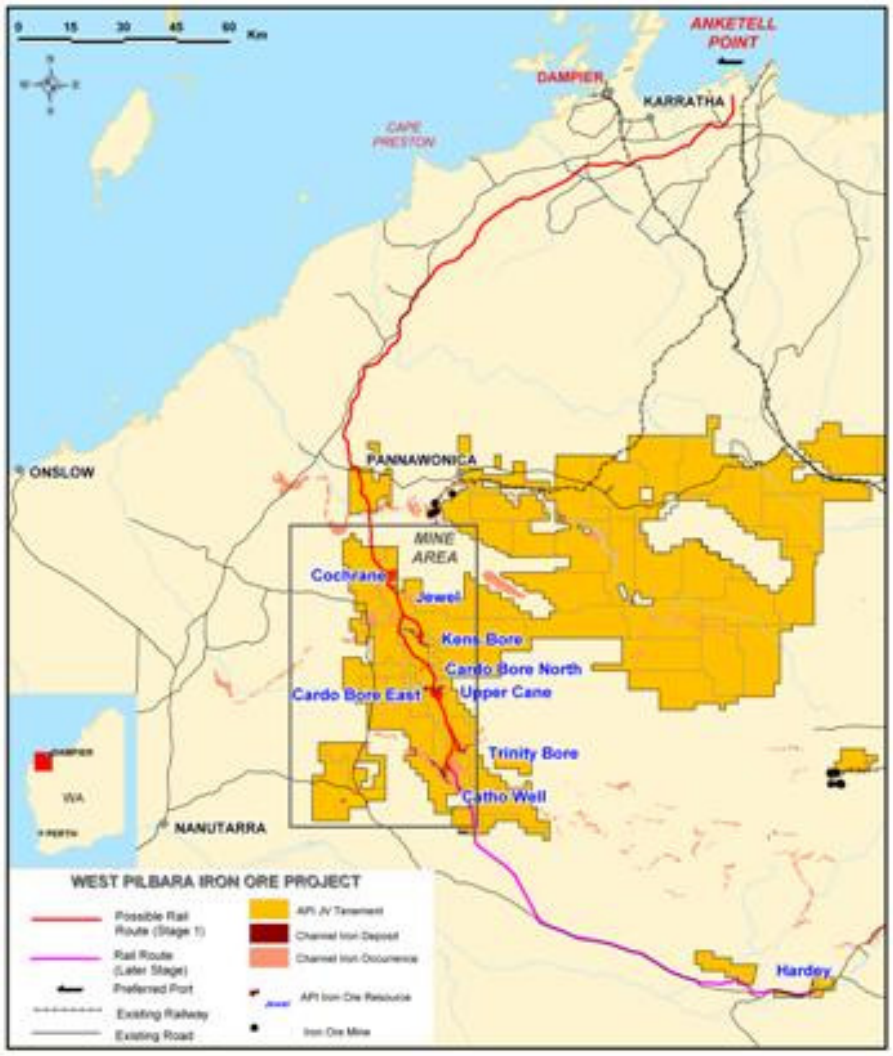


Source: Company Presentation

West Pilbara Project (Australia)

Australian Premium Iron Joint Venture (API), in which Aquila has 50% stake is developing stage 1 of this project. A pre-feasibility study was completed in May 2008. Key outcomes of pre-feasibility were 25mtpy ore mining/export potential and A$4bn capex. A Definitive Feasibility Study was completed in 2010 including a detailed engineering of a 30mtpa pisolite mine and associated port/rail infrastructure, with capex increasing to A$6b. Environmental approvals at the mine and for the new port at Anketell Point are expected in 2012. Depending on financing and commitment by the JV partners, first iron ore shipment is unlikely until 2015 at the earliest. There is also a pre-feasibility study for an additional 10mtpa of bedded iron ore from the Hardey deposit that has a resource of 742mt.

Figure 171. West Pilbara Iron Ore Project Location

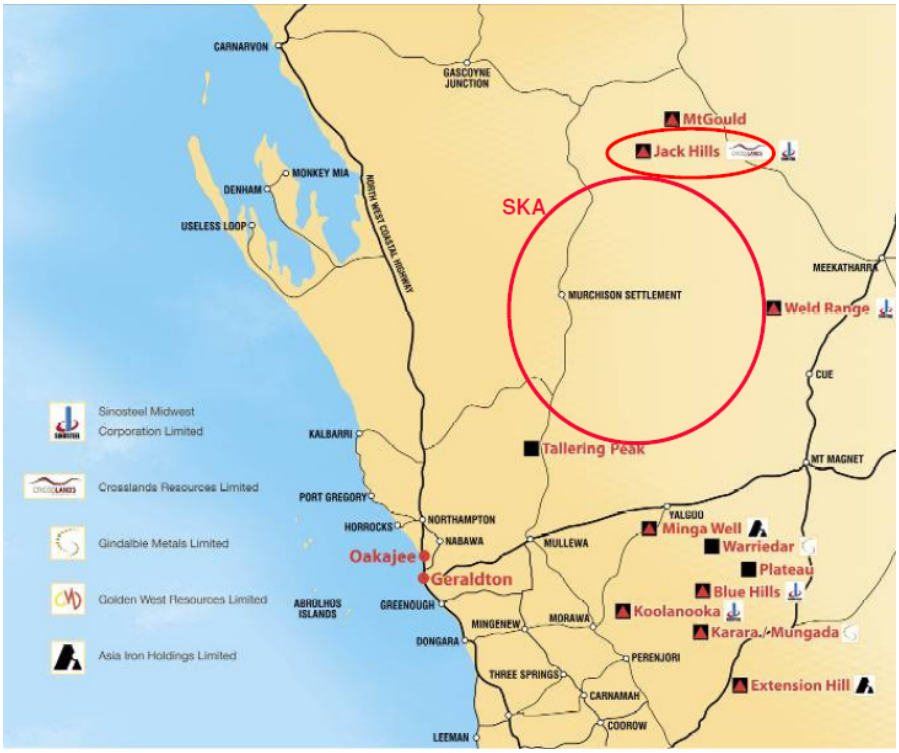


Source: Company Presentation

Jack Hills (Australia)

Jack Hills is in Western Australia's mid-west region. The mine is producing 2 mt of lump and fine ore annually. The project is being evaluated for a 35 mtpa expansion by JV partners supported by 2 Bt measured and indicated resources base. The proposed plan will include development of Oakajee port and railway network to ship ore and is subject to environmental approval and offtake agreement.

Figure 172. Western Australia's mid-west mining area



Source: Crosslands presentation

Minas Rio (Brazil)

The project is located in the state of Minas Gerais in Brazil with proposed annual capacity of 27 mtpa of iron ore pellet feed. The company is also building a 525km pipeline to transport ore slurry to the port of Acu. The port has a nameplate storage capacity of 2.5 mt and is jointly owned by Anglo (49%) and LLX (51%). First production of the project is expected in the second quarter of 2012.

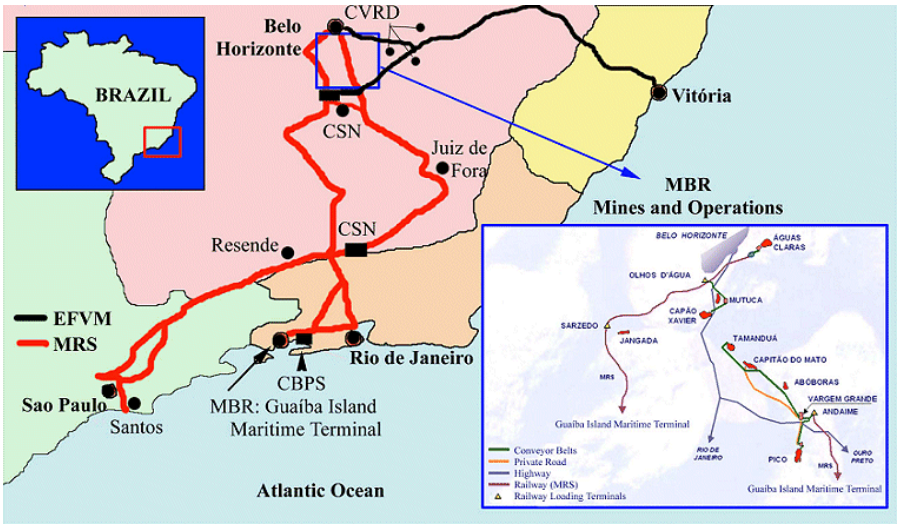
Figure 173. Minas Rio project

Source: Anglo American presentation on Minas Rio

Apolo (Brazil) – Vale

The Apolo iron ore project is in the iron quadrangle of Brazil near the cities of Caete and Santa Barbara, state of Minas Gerais. Vale will invest US$2.5bn for the development of open-pit mine and construction of a processing plant with nameplate capacity of about 24mtpa. The operations will be supported by EFVM rail network and Tubarao port facility, both of which are fully owned and operated by Vale. The project is expected to come on-stream in 2014 but there could be delays from environmental licensing, in our view, amid the demand from environmentalist to preservation the mountain range where Apolo is located.

Figure 174. Apolo project location



Source: Company Presentation

Kalia Phase I (Guinea)

Kalia phase I is part of the Bellzone's plan to develop a 50 mtpa iron ore project with 30 mtpa DSO production and 20 mtpa concentrate production. The project is located at 360km east of Conakry, capital of Guinea and will require substantial investment in developing railway and port facilities which will be carried out by a separate vehicle. The company is still in the process of identifying a suitable port location for the project with two locations shortlisted so far, which are subject to further technical and socio-economic surveys.

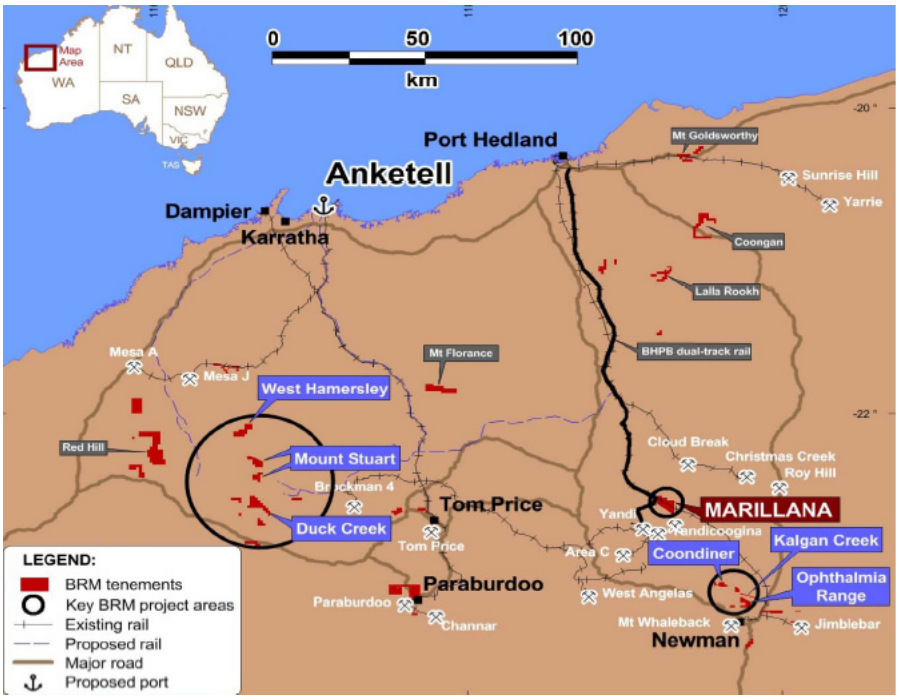
Figure 175. Kalia mining area

Source: Bellzone website

Marillana (Australia)

Marillana Iron Ore Project is in the Hamersley Iron Province within the Pilbara region of Western Australia with reported resources of 1.6bt and a reserve of 1.05bt. Key hurdle to developing the project is access to rail, with access to FMG's railway line or the potential new railway to be developed by Atlas/QR National the most likely option. The company is also part of North West Infrastructure in conjunction with Atlas that has a capacity allocation of 50mtpa at Port Hedland – 18.5mtpa attributable to Marillana. First production is unlikely until 2015 at the earliest.

Figure 176. Marillana mining project



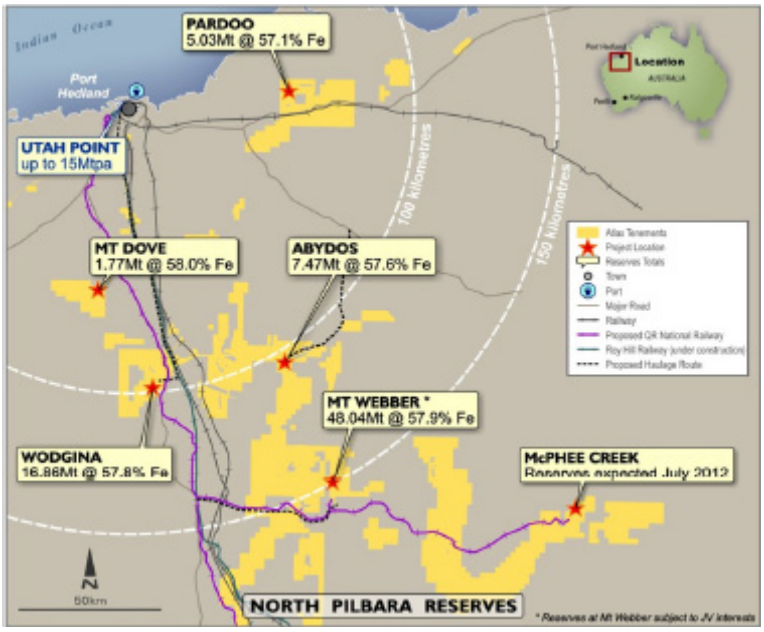
Source: Brockman website

Atlas Iron – North Pilbara DSO project (Australia)

Atlas operates two mines at Pardoo and Wodgina and is developing an additional two at Abydos and Mt Dove. The next mine due to be developed to increase capacity to 12mtpa by end 2013 will be Mt Weber.

The next stage of the growth for Atlas will require rail and a new port (North West Infrastructure), with the key mine development being McPhee Creek and a further expansion of Mt Weber.

Figure 177. North Pilbara DSO Mining area



Source: Atlas Iron

Tonkolili (Sierra Leone)

African Minerals holds the mining rights to the Tonkolili iron ore project in central Sierra Leone located approximately 200km northeast of the capital, Freetown. The company has delineated a 12.8bt ore body and plans to use a three-phased approach targeting progressively lower grade layers of duricrust, saprolite and magnetite.

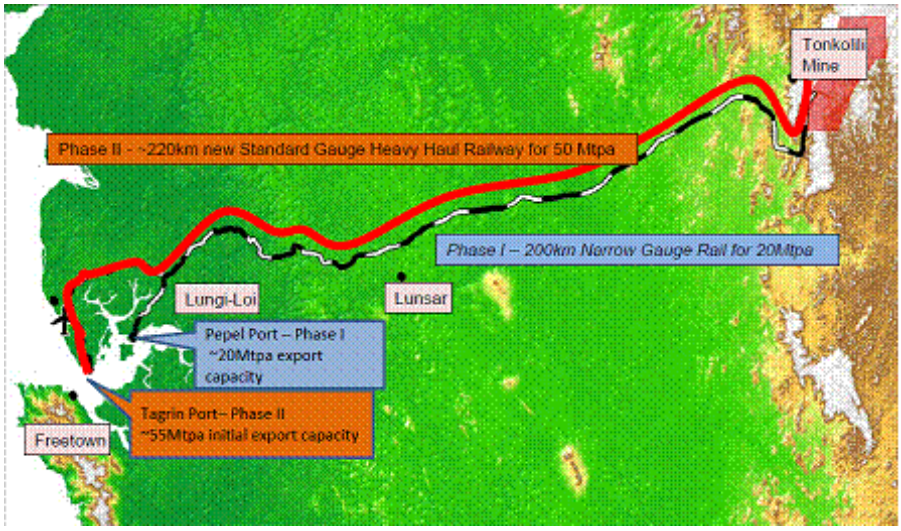
Phase one has commenced production and will exploit the high grade oxidized ore, using rehabilitated existing port and rail infrastructure for a 20mtpa direct shipping ore (DSO) operation. Phase 2, part-funded by cash from phase 1 and contributing an incremental 30mt, is more capital intensive requiring a new standard heavy gauge rail line from the mine to a new port at Tagrin as well as a concentrating process. Finally phase 3, estimated at 45mt incremental capacity, will target the low grade magnetite which forms the bulk of the resource. The third phase will require a power solution.

On 31 March 2012 Shandong Iron & Steel Group (SISG) completed its $1.5bn investment in return for a 25% shareholding in AMI's three project subsidiaries: Tonkolili Iron Ore, African Railway & Port Services and African Power (shell company for Phase 3).

Figure 178. Sierra Leone Country Map

Source: Company Reports

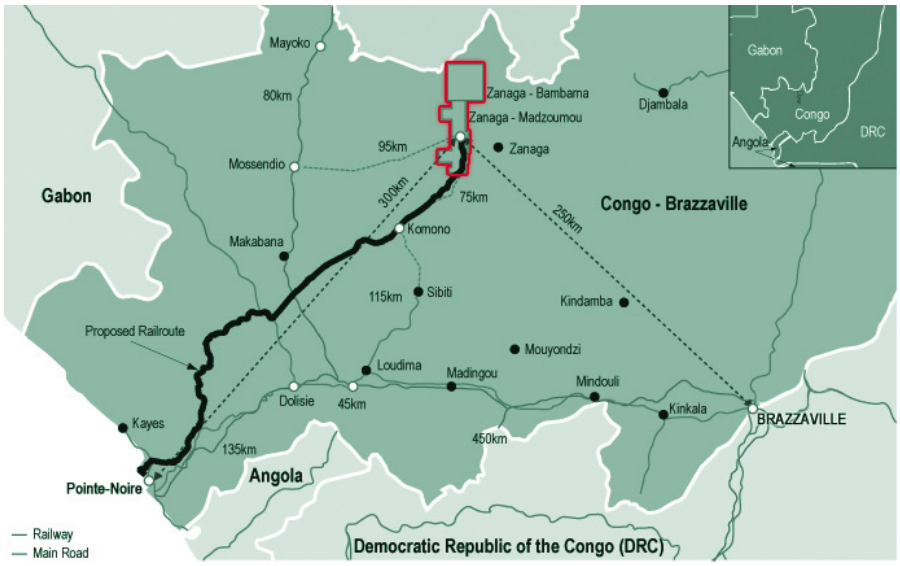
Figure 179. Tonkolili mine location and infrastructure development



Source: African Minerals

Zanaga Iron Ore Project (Republic of Congo)

Figure 180. Zanaga/Congo map



Source: Citi Investment Research and Analysis

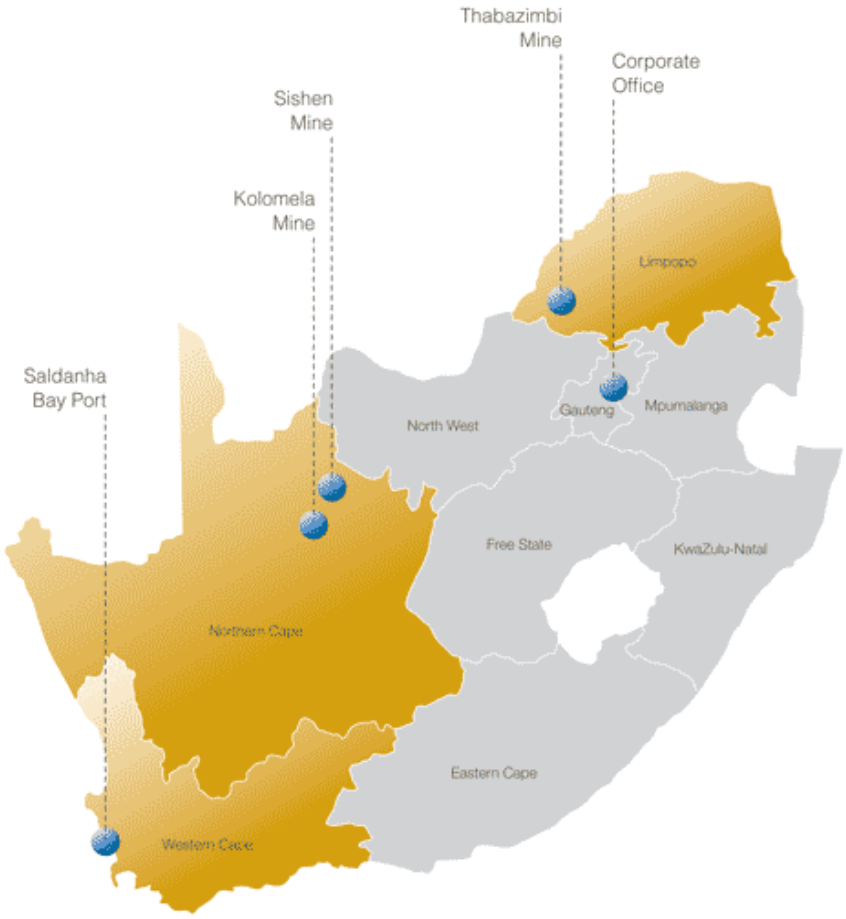
The Zanaga iron ore deposit is a mixture of hematite and magnetite material. The latest resource statement estimates a 4.3bn deposit of ~850mt hematite ore and the remainder magnetite. The deposit lies around 350km from Pointe Noire (Congo's main port) in a region with limited infrastructure, thus will require port, power and transport corridor construction before mine operations can ramp up. Phase 1 of its feasibility study was recently delivered in the form of a Value Engineering Exercise (VEE), which confirmed the economic viability of the project and refined two main options:

- 45mtpa sinter and magnetite concentrate operation with railway to port at $7.55bn capital cost.
- 30mtpa mixed hematite and magnetite pellet feed operation with slurry pipeline to port at $6bn capital cost.

Kolomela mine (South Africa)

Renamed from Sishen South project, Kolomela is expected to start production in 2012 and ramping up to full capacity of 9 mtpa by 2013. The project has a mine life of 30 years supported by a resource base of 373 Mt at 60% Fe cut off. The direct shipping ore project will have lump to fine ratio of 60:40. Transnet is committed to expanding the Sishen-Saldanha iron ore export channel from 47Mtpa to 60Mtpa: 9Mtpa of which has been allocated to Kumba for the development of Kolomela.

Figure 181. Kolomela mine



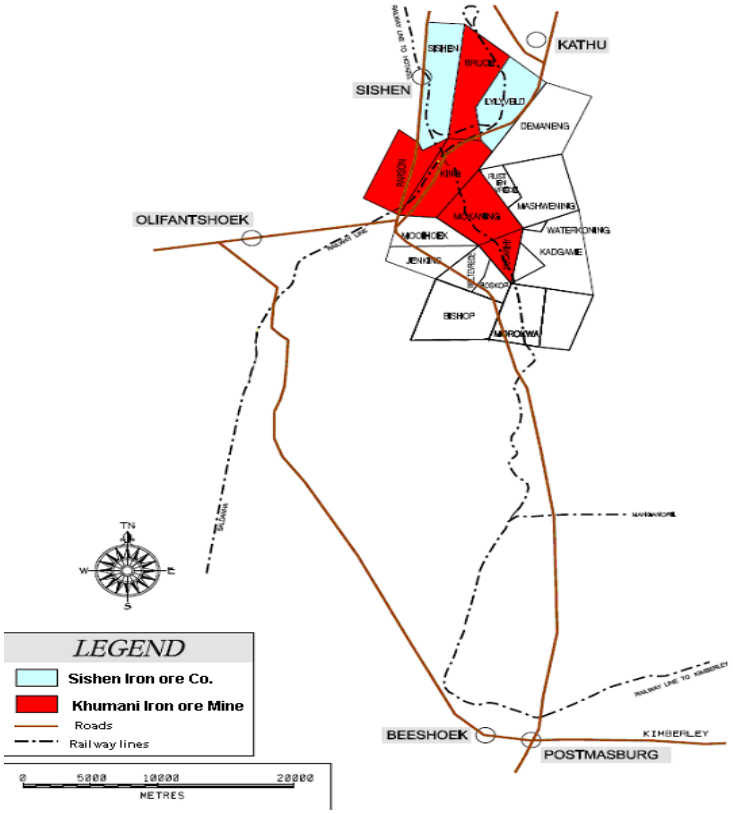
Source: Kumba Iron Ore Co. presentation

Khumani Expansion 16mtpa (South Africa)

Khumani iron ore mine (formerly the Bruce, King and Mokaning ("BKM") Project, which refers to the farms on which the iron ore resources are located) is situated in the Northern Cape province of South Africa. The iron ore deposits are approximately 60km north of the Beeshoek mine and adjacent to Kumba's Sishen Iron Ore Mine. The mine development is part of the Assmang's strategy to replace Beeshoek mine, which is nearing the end of its life. The expansion has already received Transnet railway's capacity allocation through Saldanha Bay by 2012.

Three products will be produced - lumpy, DR lump and fines. The lumpy will grade at 66% iron, while the DR lump will grade at 65.5% iron, and fines at 65% iron.

Figure 182. Khumani Mine



Source: Assmang

Marampa, Sierra Leone

The Marampa mine is located 125km by road north-east of Freetown and 40km by dedicated haul road from tidewater at the Thofeyim river terminal.

The Marampa deposit was first discovered in 1926 and open pit production was commenced by the Sierra Leone Development Company ("Delco") and William Baird between 1933 and 1975. By the 1960s iron ore production had reached 2 Mtpa before low iron ore prices forced the mines closure. Continuing weak market economics and the civil war prevented redevelopment of the mine until the mining licence was acquired by London Mining in 2006. The original railway for the mine is now owned and used by African Minerals for its Tonkolili project, hence London Mining's Haul road and barging solution.

London Mining secured an option to acquire the mining rights at the Marampa mine in December 2005. After securing funding, London Mining was able to exercise the option in January 2006 and in September 2006 the Marampa mining lease was assigned to LMC, a 100% subsidiary of London Mining. The Marampa mine recommenced production in December 2011.

London Mining is developing Marampa in two phases. Phase 1 is in production and will be expanded to produce 5Mtpa of sinter concentrates from a blend of tailings from previous operations and soft highly weathered ore. A bankable feasibility study outlining an expansion to 9Mtpa will be completed in Q3 2012.

A second bankable feasibility study will consider a further expansion to over 16Mtpa, which the company envisages would entail the construction of further crushing and processing facilities, a slurry pipeline and coal fired power station.

Figure 183. Use of ore type at each phase

Phase	Ore Type	Mt	Fe Grade (%)
Phase 1	Tailings	38	22%
	Weathered	153	34%
Phase 2	Unweathered	887	31%

Source: Company Reports, CIRA

Phase 1 at Marampa is being delivered at <$70/t capital intensity, while phases 1a and 2 are likely to be in the region of $150/t

Figure 184. London Mining in Sierra Leone

Source: Company Presentation

Outer Harbour

BHP is developing Outer Harbour port to expand its iron ore export capacity at Port Hedland, Australia. The new facility will support current and future operational and capacity requirements within Pilbara region for BHP.

Figure 185. Proposed facility – jetty and wharf structure

Source: Company reports, Public Environmental Review/Draft Environmental Impact Statement

Project parameters – Outer Harbour project has planned throughput capacity of 240 Mtpa for marine infrastructure (Landside Infrastructure nominal capacity of 300 Mtpa). Construction will be completed over 4 stages, with each stage taking about 2-3 years to complete adding 60 Mtpa export capacity per stage.

The Outer Harbour Development is likely to utilize larger capacity ships than the current inner harbour average. On this basis, the number of vessel movements per year will range between 240 (at an average of 250,000 DWT) and 350 (at an average of 170,000 DWT) vessels per stage per year.

Figure 186. Scope of Outer Harbour project

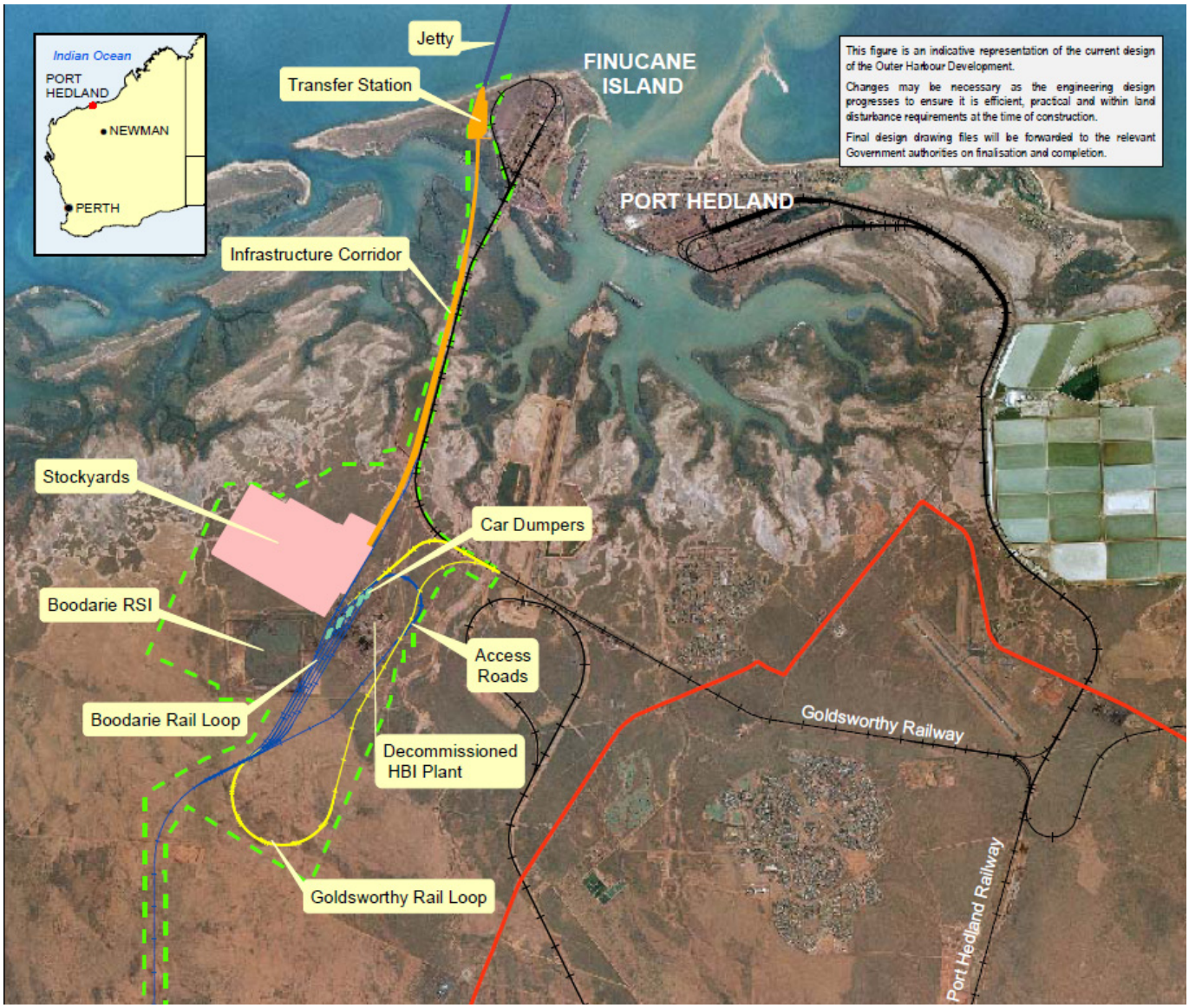
Element	Description
General	
Proponent	BHP Billiton Iron Ore Pty Ltd.
Project Location	Port Hedland, Western Australia.
Proposal Description	Staged development of rail, iron ore handling, stockpiling and shiploading facilities at Port Hedland. Infrastructure includes a jetty, wharf and shipping channel offshore of Finucane Island with onshore infrastructure including ore transport (rail) and ore handling infrastructure (car dumpers, stockyards and conveyor system) and associated supporting infrastructure.
Construction Period	Staged Construction, each stage nominally 2-3 years.
Marine Infrastructure	
Export Capacity	Marine Infrastructure nominal capacity of approximately 240 Mtpa.
Wharf	Approximately 2 kilometres (km) in length. Eight berths and four shiploaders.
Jetty	Approximately 4 km in length.
Shipping Channel	Approximately 34 km in length (first 2 km located in State waters and remaining 32 km located in Commonwealth waters).
Dredge Material	Volume: Approximately 54 million cubic metres (Mm3). Disposal: Three new offshore spoil grounds located in Commonwealth waters.
Landside Infrastructure	
Capacity	Landside Infrastructure nominal capacity of 300 Mtpa
Infrastructure Corridor	From the Boodarie stockyards to Finucane Island and includes: access roadway and tracks; five conveyors up to 8 km in length; and power, water and communication utilities (subject to separate environmental approvals);
Stockyards	Staged Development: Each stage comprises ore stockpiles; a car dumper; 2 stackers; reclaimer; and lump rescreening plant. Two rescreened fines yard.
Rail	Loop: Five rail loops, one for each car dumper. Connections to the existing rail infrastructure. Western Spur: approximately 32 km in length.
Footprint	
Vegetation Clearing	Total permanent area: Approximately 940 ha.

Source: Company data, Public Environmental Review/Draft Environmental Impact Statement

Environment impact – a large proportion of the proposed disturbance resulting from land clearing (terrestrial environment) and capital dredging (marine environment) occurs in the early development stages.

The disturbance envelope for landside infrastructure and construction activities for the Outer Harbour Development is approximately 4,270 hectares and has been developed to allow for flexibility in locating project infrastructure during detailed engineering design.

Figure 187. Proposed landside infrastructure layout and location of Outer Harbour



Source: Company data, Orthorectified Aerial Photograph: (BHPBIO) Topography: Geoscience Australia, GEODATA Topo 250K V3 (Copyright Commonwealth of Australia)

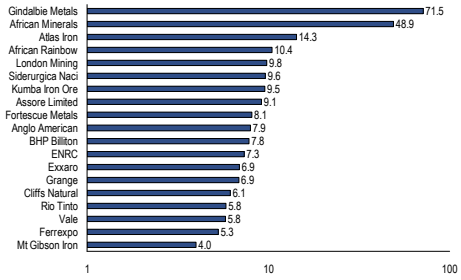
Figure 188. Outer Harbour Project Summary

Outer Harbour (240mtpa+) BHP Billiton 85% FYE June		2012F	2013F	2014F	2015F	2016F	2017F	2018F	2019F	2020F
Revenue	US$m	0	0	0	0	1,031	2,988	4,893	6,241	6,926
Operating Costs	US$m	0	0	0	0	-364	-1,103	-1,729	-2,352	-2,662
EBITDA	US$m	0	0	0	0	667	1,885	3,164	3,889	4,264
Depreciation	4.5	0	0	0	0	-53	-164	-279	-386	-438
EBIT	US$m	0	0	0	0	614	1,722	2,885	3,503	3,825
Tax	US$m	0	0	0	0	-178	-499	-837	-1,016	-1,109
PAT	US$m	0	0	0	0	436	1,223	2,048	2,487	2,716
Project Capex - BHP Share	16,830	390	1,231	3,273	3,740	3,740	3,740	717	0	0
SIB Capex - BHP Share	2.0%	0	0	0	0	210	543	685	715	727
Total Capex - BHP Share	32,439	**390**	**1,231**	**3,273**	**3,740**	**3,950**	**4,283**	**1,401**	**715**	**727**
Free Cash Flows (Nominal)	US$m	-390	-1,231	-3,273	-3,740	-3,461	-2,896	926	2,158	2,428
Free Cash Flows (Real)	US$m	-385	-1,191	-3,093	-3,452	-3,118	-2,546	788	1,803	1,980
NPV at 8.30% Real WACC	**11.6%**	2,221	3,218	5,752	9,941	14,386	18,625	21,468	21,477	21,110
NPV at 10.50% Real WACC	**-3.4%**	-658	98	2,408	6,429	10,780	15,003	17,901	17,980	17,685
Project IRR	**10.1%**									
Annual Cash Flows	US$m	-385	-1,576	-4,669	-8,121	-11,238	-13,785	-12,997	-11,194	-9,214
Payback period	**9.2**									
Closing Operating Assets	US$m	390	1,621	4,893	8,633	12,530	16,649	17,771	18,100	18,388
EBITDA Margin	%					65%	63%	65%	62%	62%
EBIT Margin	%					60%	58%	59%	56%	55%
ROA (Annualised)	%					**4%**	**8%**	**12%**	**14%**	**15%**
A$/U$	x	1.03	1.00	0.93	0.91	0.90	0.90	0.90	0.90	0.90
US CPI Inflator		1.01	1.04	1.06	1.09	1.12	1.15	1.17	1.20	1.23
Lump FoB	US$/t	169.3	143.9	129.3	115.8	111.9	105.3	102.5	97.0	97.0
Fines FoB	US$/t	146.1	124.2	111.6	99.9	96.6	90.9	88.5	83.7	83.7
Avg Realised Price (Real)	US$/t	-	-	-	-	43.4	83.1	78.9	72.9	71.1
Avg Unit Cost	A$/t	-	-	-	-	15.4	31.3	29.2	29.9	30.6
Attributable Royalties	US$m									
Capacity (100%)	mtpa	-	-	-	-	25	50	75	94	94
Production (100%)	mt	-	-	-	-	13	38	63	84	94
Production Attributable	mt	-	-	-	-	11	32	53	72	79
Lumps	*mt*	-	-	-	-	*3*	*8*	*14*	*18*	*20*
Fines	*mt*	-	-	-	-	*8*	*24*	*39*	*53*	*59*

Source: Citi Investment Research and Analysis forecasts

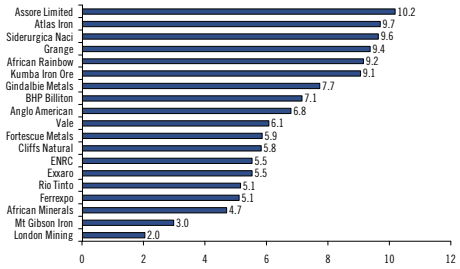
Company Valuation Metrics

Figure 189. 2012 P/E



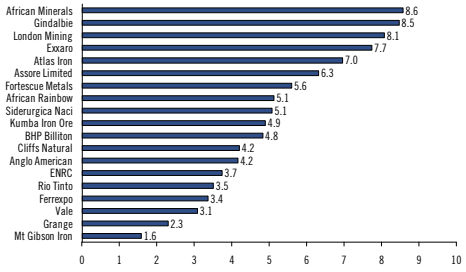
Source: dataCentral, Citi Investment Research and Analysis

Figure 190. 2013 P/E



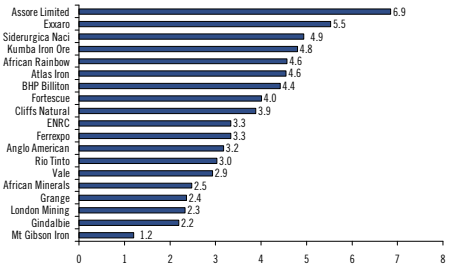
Source: dataCentral, Citi Investment Research and Analysis

Figure 191. 2012 EV/EBITDA



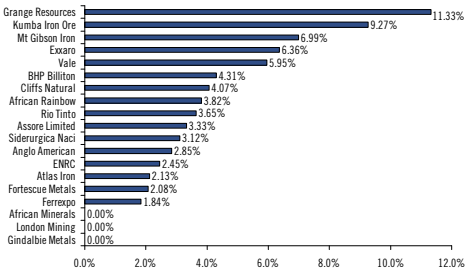
Source: dataCentral, Citi Investment Research and Analysis

Figure 192. 2013 EV/EBITDA



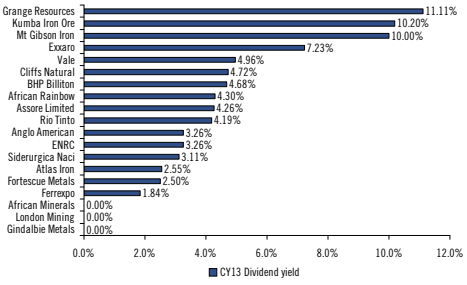
Source: dataCentral, Citi Investment Research and Analysis

Figure 193. 2012 Dividend Yield



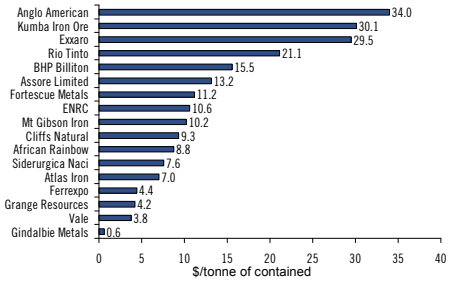
Source: dataCentral, Citi Investment Research and Analysis

Figure 194. 2013 Dividend Yield



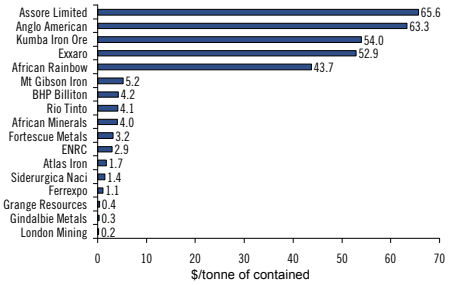
Source: dataCentral, Citi Investment Research and Analysis

Figure 195. EV/tonne reserve ($/t contained Fe)



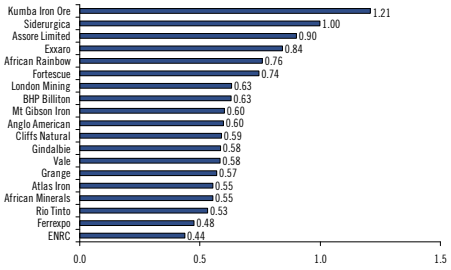
Source: dataCentral, Citi Investment Research and Analysis

Figure 196. EV/tonne resource ($/t contained Fe)



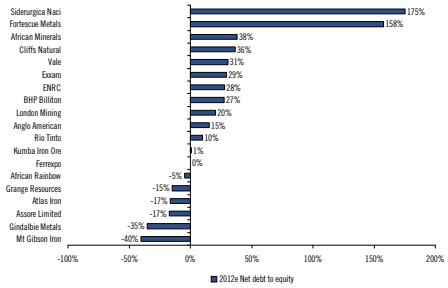
Source: dataCentral, Citi Investment Research and Analysis

Figure 197. P/NPV



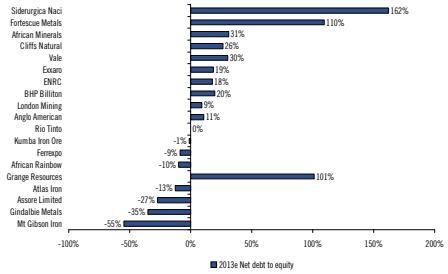
Source: dataCentral, Citi Investment Research and Analysis

Figure 198. 2012 Net Debt/Equity



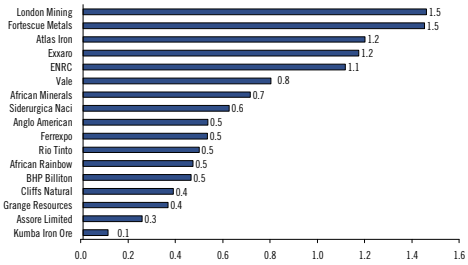
Source: dataCentral, Citi Investment Research and Analysis

Figure 199. 2013 Net Debt/Equity



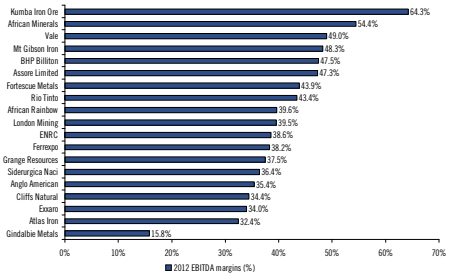
Source: dataCentral, Citi Investment Research and Analysis

Figure 200. 2012 Capex/EBITDA



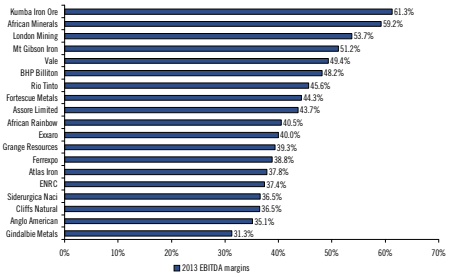
Source: dataCentral, Citi Investment Research and Analysis

Figure 201. 2012 EBITDA Margins



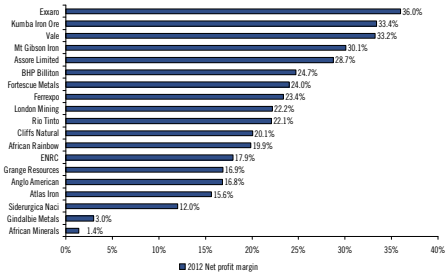
Source: dataCentral, Citi Investment Research and Analysis

Figure 202. 2013 EBITDA Margins



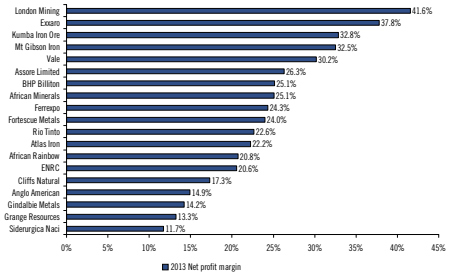
Source: dataCentral, Citi Investment Research and Analysis

Figure 203. 2012 Net Profit Margins



Source: dataCentral, Citi Investment Research and Analysis

Figure 204. 2013 Net Profit Margins



Source: dataCentral, Citi Investment Research and Analysis

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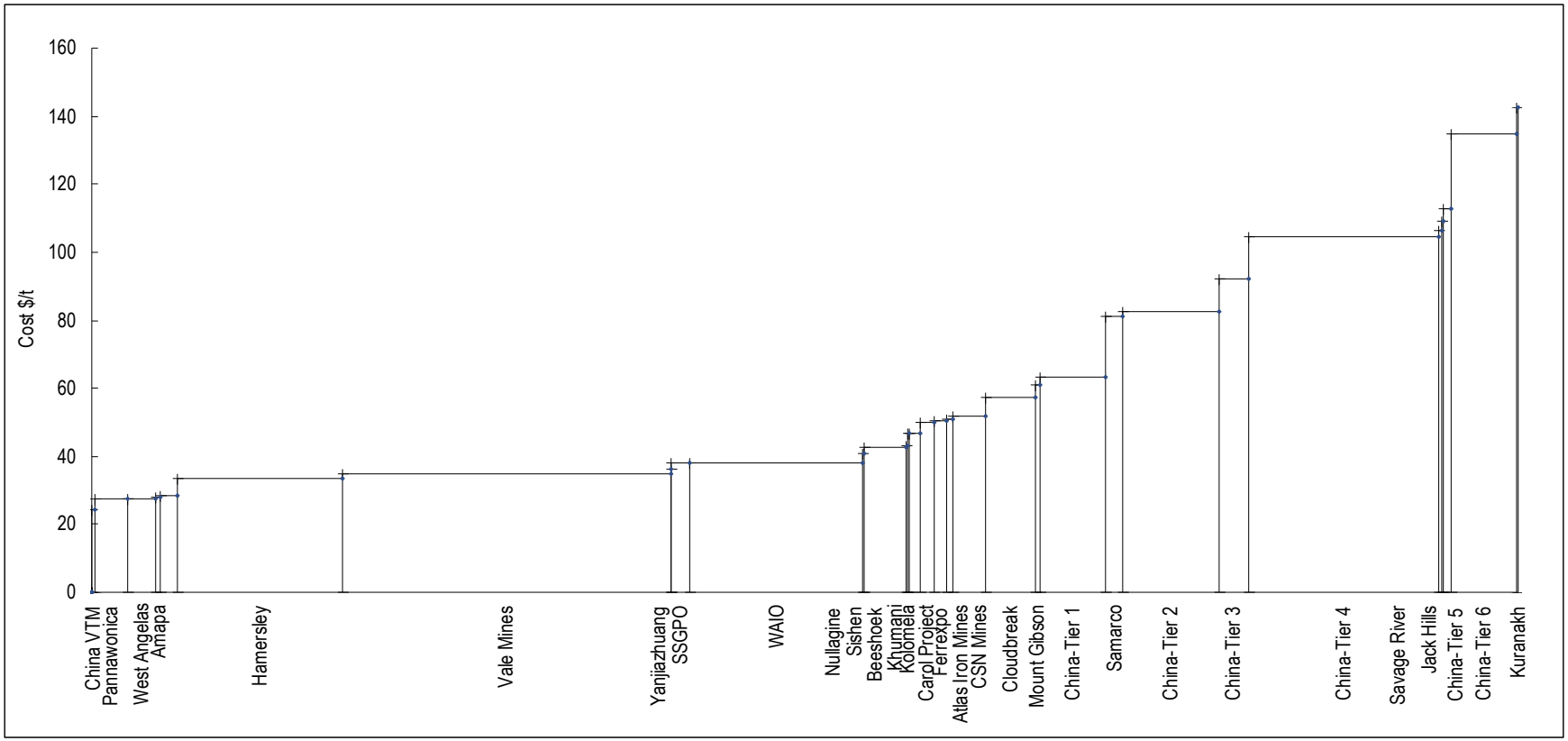
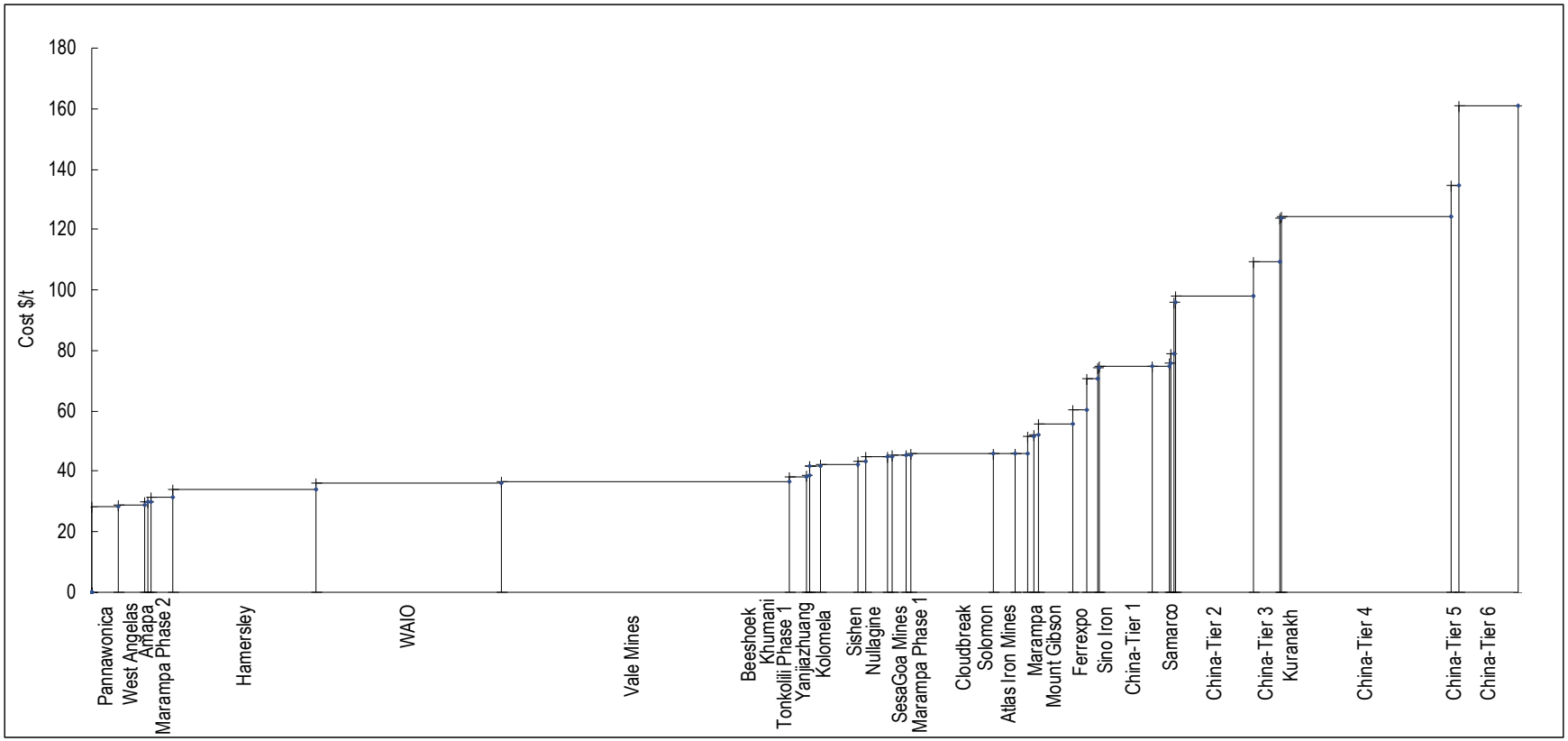
Cost Curves

Figure 205. Citi 2011 Iron Ore Cost Curve



Source: Citi Investment Research and Analysis

Figure 206. Citi 2014 Iron Ore Cost Curve



Source: Citi Investment Research and Analysis

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Full Project List

Figure 207. Global Iron Ore supply 2010-2020F

Company/Region	Project	Country	2010E	2011F	2012F	2013F	2014F	2015F	2016F	2017F	2018F	2019F	2020F	2020 Company Targets	Weight	Progress
Rio Tinto	Rio Tinto	Australia	220	220	220	220	220	220	220	220	220	220	220	220	100%	Base Case
Rio Tinto	10mtpa at Dampier	Australia		10	10	10	10	10	10	10	10	10	10	10	100%	Base Case
Rio Tinto	Expansion to 333mtpa - part 1	Australia				10	30	50	50	50	50	50	50	50	100%	Base Case
Rio Tinto	Expansion to 333mtpa - part 2	Australia						10	30	40	50	50	50	50	100%	Base Case
BHP Billiton	BHP Billiton	Australia	138	155	155	155	155	155	155	155	155	155	155	155	100%	Base Case
BHP Billiton	RGP5	Australia			10	35	50	50	50	50	50	50	50	50	100%	Base Case
BHP Billiton	RGP6	Australia						35	35	35	35	35	35	35	100%	Base Case
BHP Billiton	Quantum 1	Australia							30	59	88	115	115	115		Base Case
Fortescue	Fortescue	Australia	38	40	40	40	40	40	40	40	40	40	40	40	100%	Base Case
Fortescue	Chichester 1	Australia		3	13	15	15	15	15	15	15	15	15	15	100%	Base Case
Fortescue	Chichester 2	Australia				10	25	40	40	40	40	40	40	40	100%	Base Case
Fortescue	Solomon	Australia					6	30	54	60	60	60	60	60	100%	Base Case
Portman*	Portman	Australia	8	8	8	8	8	8	8	8	8	8	8	8	100%	Base Case
Gindalbie Metals	Karara	Australia		1	6	10	13	16	16	16	16	12	12	12	100%	Base Case
Territory Resources*	Territory Resources	Australia	2	2	2	2	3	3	3	3	3	3	3	3	100%	Probable
Mount Gibson Iron Ore	Mount Gibson Iron Ore	Australia	6	5	8	9	7	7	6	4	4	1		0	100%	Probable
Atlas Iron	Atlas Iron	Australia	2	4	7	11	12	15	19	19	19	19	19	19	30%	Probable
FerroAus*	FerroAus	Australia						2	2	4	6	8	10	10	15%	Probable
Hancock Prospecting*	Roy Hill	Australia					5	20	20	20	20	20	20	50		Probable
Iron Ore Holdings*	Iron Ore Holdings	Australia					3	3	3	3	3	3	3	12	30%	Probable
BC Iron*	BC Iron	Australia												3	30%	Probable
Grange Resources	Savage River	Australia	2	2	3	3	3	3	3	3	3	3	3	7	30%	Probable
Grange Resources	Southdown	Australia							3	8	14	14	14	14	30%	Possible
Brockman Resources*	Marillana	Australia						3	6	10	17	17	17	17	15%	Probable
Ironclad Mining*	Ironclad Mining	Australia					1	1	1	1	1	1	1	4	15%	Probable
Aquila*	Aquila	Australia						6	8	10	20	30	30	30	20%	Probable
Sino Midwest*	Sino Midwest	Australia	1	3	4	4	4	4	4	4	4	4	4	7	60%	Probable
Citic Pacific Mining*	Sino Iron	Australia			5	13	16	20	25	25	25	25	25	27	90%	Probable
MMX*	Jack Hills	Australia	2	2	2	2	3	6	15	25	30	30	30	30	0%	Probable
Cliffs Natural Resources	Koolyanobbing Expansion	Australia			1	2	3	3	3	3	3	3	3	3		Probable
TOTAL AUSTRALIA			**420**	**456**	**493**	**558**	**631**	**773**	**873**	**939**	**1,008**	**1,040**	**1,041**	**1,095**		
Vale	Vale	Brazil	310	320	320	315	310	305	300	300	300	300	300	310	100%	Base Case
Vale	Carajas Serra Leste	Brazil								5	6	6	6	20	0%	Base Case
Vale	Carajas +40	Brazil					15	40	40	40	40	40	40	40	100%	Base Case
Vale	Carajas Serra Sul	Brazil								10	40	60	90	90	50%	Base Case
Vale	Conceicao Itabiritos	Brazil				6	12	12	12	12	12	12	12	12	100%	Base Case
Vale	Vargem Grande Iabiritos	Brazil				5	10	10	10	10	10	10	10	10	100%	Base Case
CSN	CSN - Casa De Pedra	Brazil	22	22	24	28	32	36	40	40	40	40	40	24	100%	Base Case
CSN	CSN - Namisa	Brazil	6	6	6	6	10	10	11	12	15	19	20	10	50%	Base Case
MMX	MMX Corumba	Brazil	1	2	2	2	2	2	2	2	2	2	2	15	100%	Base Case
MMX	MMX Sudeste	Brazil	0	3	6	6	6	12	20	24	24	24	24	50	50%	Base Case
Anglo American	Minas Rio Phase 1	Brazil				3	10	27	27	27	27	27	27	20	100%	Probable
Anglo American	Minas Rio Phase 2 and 3	Brazil									20	40	54	3		Possible
Anglo American	Amapa	Brazil	4	4	4	4	4	4	4	4	4	4	4	24	100%	Base Case
Usiminas	Usiminas	Brazil	6	8	8	8	8	8	20	29	29	29	29	27	100%	Base Case
Gerdau	Gerdau	Brazil	2	2	2	2	4	6	6	6	6	6	6	54		
Ferrous Resources	Ferrous Resources	Brazil				0	0	0	0	0	0	0	0	4	0%	Base Case

ENRC Brazil	ENRC	Brazil				0	0	0	0	0	0	0	0	13		
Vetria	ALL	Brazil				0	0	0	0	0	0	0	0	16		
Manabi	Manabi	Brazil				0	0	0	0	0	0	0	0	25		
Brazil - Other	Brazil - Other	Brazil	10	10	10	10	10	10	10	10	10	10	10	10	100%	Base Case
TOTAL BRAZIL			**361**	**377**	**382**	**395**	**433**	**482**	**502**	**531**	**585**	**629**	**674**	**697**		
Sphere Minerals*	Askaf	Mauritania			2	2	2	4	4	6	6	6	6	6	90%	No
Sphere Minerals*	Guelb el Auoj	Mauritania						7	7	7	7	7	7	7	50%	Probable
Sphere Minerals*	Lebtheinia	Mauritania												30	100%	No
SNIM*	M'haoudat	Mauritania	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3		100%	
African Aura*	Putu	Liberia							10	20	20	20	20	20	39%	No
African Minerals	Tonkolili Phase 1	Sierra Leone			10	20	20	20	20	20	0	0	0	0	100%	Probable
African Minerals	Tonkolili Phase 2	Sierra Leone						10	27	30	30	30	30	30	75%	Probable
African Minerals	Tonkolili Phase 3	Sierra Leone											16	45	75%	Probable
Cape Lambert*	Marampa	Sierra Leone			2	5	5	5	5	5	5	5	5	11	100%	Possible
London Mining	Marampa Phase 1	Sierra Leone			2	4	5	9	9	9	9	9	9	9	100%	Probable
London Mining	Marampa Phase 2	Sierra Leone							4	8	8	8	8	8	100%	Probable
Bellzone*	Kalia Phase 1 DSO	Guinea					10	20	20	20	20	20	20	20	100%	No
Bellzone*	Kalia Phase 1 Conc	Guinea						5	10	10	10	10	10	10	100%	No
Bellzone*	Kalia Phase 2 DSO	Guinea								5	10	10	10	10	100%	No
Bellzone*	Kalia Phase 2 Conc	Guinea									5	10	10	10	100%	No
Rio Tinto	Simandou	Guinea						23	45	68	90	90	90	90	0%	Possible
														15	0%	
Vale / BSG Resources	Simandou	Guinea					5	5	5	5	5	5	5			
Iron Ore Junior*	Mbalam	Cameroon					10	30	35	35	35	35	35	35	90%	Possible
ArcelorMittal	Nimba	Liberia		1	2	4	14	14	0	0	0	0	0	14		Possible
ArcelorMittal	Faleme	Senegal												15-25		Possible
African Iron*	Mayoko	ROC				2	5	5	5	5	5	5	5	5	80%	No
Core Mining*	Avima	ROC						5	10	20	20	20	20	20	100%	No
Zanaga	Zanaga	ROC							6	27	45	45	45	45	50%	Possible
Kumba	Kolomela	S Africa	36	38	44	47	47	47	49	51	53	56	59	70	100%	
Assmang	Khumani	S Africa	10	10	12	13	16	16	16	16	16	16	16	16	100%	
TOTAL AFRICA			**56**	**59**	**84**	**107**	**149**	**235**	**297**	**377**	**409**	**417**	**436**	**526**		
CAP*	CAP	Chile	10	10	10	12	14	16	16	16	16	16	16	20	100%	Probable
India	India Major Projects	India	20	30	40	40	40	40	40	40	40	40	40	40	100%	Probable
India	India Other Exports	India	50	35	25	25	25	25	25	25	25	25	25	25	100%	Probable
Canada	Canada Other Exports	Canada	15	25	25	25	25	25	25	25	25	25	25	25	100%	Probable
Ferrexpo	GPL Mine	Ukraine	10	10	10	9	9	9	9	9	9	9	9	9		Probable
Ferrexpo	Yeristovskoye	Ukraine				3	3	3	3	3	3	3	3	3		Probable
China	China Domestic	China														Probable
TOTAL OTHERS			105	110	110	114	116	118	118	118	118	118	118	2,889		
Total seaborne supply			**950**	**1,015**	**1,084**	**1,202**	**1,389**	**1,677**	**1,833**	**2,022**	**2,236**	**2,338**	**2,388**	**1,994**		
Incremental supply				**66**	**135**	**252**	**439**	**727**	**883**	**1,073**	**1,286**	**1,388**	**1,439**	**1,044**		
Cumulative % on 2012						**11%**	**28%**	**55%**	**69%**	**87%**	**106%**	**116%**	**120%**	**121%**		
YoY%			**4%**	**7%**	**7%**	**11%**	**16%**	**21%**	**9%**	**10%**	**11%**	**5%**	**2%**	**0%**		

Source: Citi Investment Research and Analysis, *Company Data

Companies Mentioned

Figure 208. Companies mentioned – Target Prices and Ratings

Company	Ticker	Listing Currency	Rating	Prices as at 16-May-12	Target price	Upside	Div. yield	ETR
Anglo American	AAL.L	GBP	2	20.76	25.00	20.4%	2.9%	23.3%
Atlas Iron	AGO.AX	AUD	1	2.28	3.50	53.5%	1.8%	55.3%
African Minerals	AMIq.L	GBP	1	4.23	7.50	77.3%	0.0%	77.3%
African Rainbow	ARIJ.J	ZAR	1	175.00	220.00	25.7%	3.4%	29.1%
Assore Limited	ASRJ.J	ZAR	1	269.98	280.00	3.7%	2.6%	6.3%
BHP Billiton	BLT.L	GBP	1	17.47	23.00	31.7%	3.4%	35.1%
Cliffs Natural	CLF.N	USD	1	51.37	92.00	79.1%	4.9%	84.0%
Siderurgica Naci	CSNA3.SA	BRL	3	13.56	17.00	25.4%	4.6%	30.0%
ENRC	ENRC.L	GBP	1	4.77	7.50	57.4%	4.0%	61.4%
Exxaro	EXXJ.J	ZAR	2	184.65	220.00	19.1%	7.0%	26.2%
Fortescue Metals	FMG.AX	AUD	1	4.91	7.50	52.7%	1.8%	54.6%
Ferrexpo	FXPO.L	GBP	1	2.25	4.25	88.8%	1.9%	90.7%
Gindalbie Metals	GBG.AX	AUD	1H	0.46	0.80	75.8%	0.0%	75.8%
Grange Resources	GRR.AX	AUD	1H	0.47	0.80	70.2%	10.6%	80.9%
Kumba Iron Ore	KIOJ.J	ZAR	3	521.24	430.00	-17.5%	8.8%	-8.7%
London Mining	LOND.L	GBP	1	2.55	4.65	82.2%	0.0%	82.2%
Mt Gibson Iron	MGX.AX	AUD	1H	0.95	1.50	57.9%	9.5%	67.4%
Rio Tinto	RIO.L	GBP	1	29.12	49.00	68.3%	2.4%	70.7%
Usiminas	USIM5.SA	BRL	3	10.05	11.00	9.5%	2.5%	11.9%
Vale	VALE.N	USD	1	18.58	32.00	72.2%	8.1%	80.3%
Zanaga Iron Ore	ZIOC.L	GBP	1H	0.98	1.50	53.5%	0.0%	53.5%

Source: Citi Investment Research and Analysis

Notes

Appendix A-1

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