

# Whatever happened to new supply?

How the 2008 global meltdown has planted the seeds for the next commodity bull market



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## Executive summary

*2008 credit crunch – 1998 Asian crisis revisited. \$200bn of projects shelved, suspended or delayed planting the seeds for the next bull run*

We believe the market is unaware of the pending supply crisis in key commodities such as copper, coal and iron ore. These shortages are a hangover from the 2008 economic crisis and the postponement or cancellation of nearly \$200bn worth of new mining projects after the Bear Stearns' collapse.

Today, many of these projects are up to three years behind their original schedule. Western banks have closed their books to new projects and equity markets are still nervous about funding projects that are more than two years away from being cashflow generative. Investors from China are among the few prepared to lend and invest directly into projects, but even they have experienced delays in many of their overseas investments.

We have analysed more than 800 copper, iron ore, coking and thermal coal projects that exist today and fewer than 25% of them are likely to see production in the next five years. In this report, we introduce a supply forward curve, illustrating how the production plans of the industry have changed dramatically since early 2008 (pre-crisis). Large chunks of supply that were to come onstream in 2010/11 have now been pushed out to 2013/14 at the earliest. We believe this will be very bullish for near-term prices.

Time will tell if the 'double dip' recession eventuates and foils our bullish outlook. That said, copper, iron ore and coking coal have held up remarkably well during the recent market jitters. In reality, demand does not need to be that strong for commodity prices to rise given that supply is extremely tight.

*Copper likely to spike to \$12,000/t?*

We think copper has the potential to spike to \$12,000/tonne in the next two years. We also think the supply forward curve could flatten and rally on the long end as we believe not one of the seven largest copper producers will be undertaking any new copper production in 2011 or 2012.

*Iron ore at \$200/t?*

We believe iron ore prices could rally to \$200/tonne in the next 12 months. Most projects were postponed after the 2008 crisis and will not impact the market until 2014, in our view.

*Coking coal at \$350/t?*

For coking coal, Mongolia could provide the only near-term swing factor as we think Mozambique will be slow to ramp up. Coking coal prices could jump back to previous highs of \$350/t in the near term, while thermal coal looks ready to ignite. China and India are in a race to gain control of new production outside their borders. We believe the Indonesian and Australian ramp-ups will take longer than expected to come onstream and South Africa needs more coal for its own consumers. Newcastle export prices could spike back to \$150/tonne near term.

*Thermal at \$150/t?*

The big winners, in our view, are the coal, iron ore and copper producers (particularly those that have near-term growth). Mining equipment suppliers, shippers and port operators and alternative energy companies also stand to gain. The losers, in our view, remain the regulated energy suppliers in China as their margins would be squeezed by higher coal prices.

Please contact us if you need our interactive supply & demand models on iron ore, copper, thermal and coking coal.



## Supply, supply, supply

- Nearly \$200bn worth of projects were delayed or cancelled post the 2008 credit crisis.
- Gaping hole in mine supply expected during 2010-13, but oversupply by 2015 likely
- We could be on the verge of a mega commodity bull market. Is inflation roaring back?
- 300mt or 32% of iron ore capacity delayed till 2014. Severe shortages anticipated in 2011.
- 3.5mt or 18% of copper capacity delayed till 2014. Consumers destocked in a tight market.
- Thermal coal supply will likely miss targets as generating capacity grows in India and China.
- Mongolia is a big winner in coking coal but not likely to impact prices near term.
- Capex (copper, coal, iron ore) is likely to peak in 2013 at \$60bn.
- Mining equipment suppliers are likely to benefit.

### An industry caught in a time warp

*Nearly \$200 billion worth of projects were cancelled/delayed due to financial crisis; on average projects are delayed by 2-3 years leading to an air pocket in supply*

The 2008 financial crisis and its lingering effects today have planted the seeds for the next mega bull run in the commodities market as the industry is caught in a time warp, we believe. The recent Euro debt crisis further exacerbates the problem. Nearly \$200 billion of mining projects were delayed or cancelled in the months after the collapse of Lehman Brothers and Bear Stearns. At the time, mining executives reacted by making wholesale cutbacks to their production and capex plans. Over 130 projects (worth \$200 billion) were either 'put under review' or 'cancelled' as financing dried up and smaller companies could not raise money in the equity markets. Today, most copper, iron ore and coal projects are facing delays of at least 2 to 3 years from their earlier plans before the crisis. Even the larger companies with strong balance sheets seem less than willing to push the boat out on new mines. This is a major U-turn from their 'build, build, build' mentality they marketed so aggressively before the crash in 2008. In short, we think the supply side will miss targets more than the demand side, especially for iron ore, copper and thermal and coking coal.

### Our analysis of nearly 800 projects

We think we are the first to build a supply forward curve that examines how the industry has changed its production plans since the 2008 financial crisis. The market tends to focus on what the supply curve looks like today and quickly forgets what it looked like before the crisis. In the process, we analysed some 236 copper projects, over 302 projects in thermal coal, 155 in iron ore and some 83 coking coal projects. We approached this using company reports, websites and phone interviews. We acknowledge it is not a perfect study and we may have missed the odd project here or there, but this represents our best estimate of what will come onstream. We also use our own interpretation of when projects will come onstream versus the official stance from the companies. We find that mining executives often hold out for as long as possible before they announce delays to their project start-up dates.

### Few projects coming onstream in 2010/11

*Supply response is similar to Asia crisis in 1997, but demand recovery stronger*

As a result of the 2008 crisis, new supply that was supposed to come onstream in 2010/11 is now unlikely to see the light of day until 2014 at the earliest. It seems that mining executives are wary about bringing on new capacity given that global economic recovery is still in an initial, tentative stage. This has similarities with the 1997 Asian financial crisis when the mining industry froze capex for the next six years and set the scene for the 2002–8 commodity bull market. This time around, demand recovery has been much faster than seen in the 1997 crisis, but now the market is nervous of a double-dip recession and mining CEOs are reading the same newspapers as investors.



## Buy Resources when it feels wrong, we say

On the face of it, this would seem to be the worst time to buy the cyclical names given the austerity measures in Europe, concerns about China's growth and a potential double dip recession in the US. It now feels a lot like in May 2004, when the market sold down the cyclicals, as China cramped down too heavily on bank lending. Today, the market appears to be absorbed with demand-side issues, forgetting about the supply concerns in the industry. With China buying coking coal from Virginia in the US, it is clear that there is a problem with supply – but the market has not yet responded to this. We note that investors typically make the most money buying resources stocks when the market is expecting a global slowdown. The last thing we would do is to buy when the salesmen are euphoric and phones are ringing off the hook with investors eager to learn more about the sector. Right now, most investors feel it is too early.

## What about a 'double dip'?

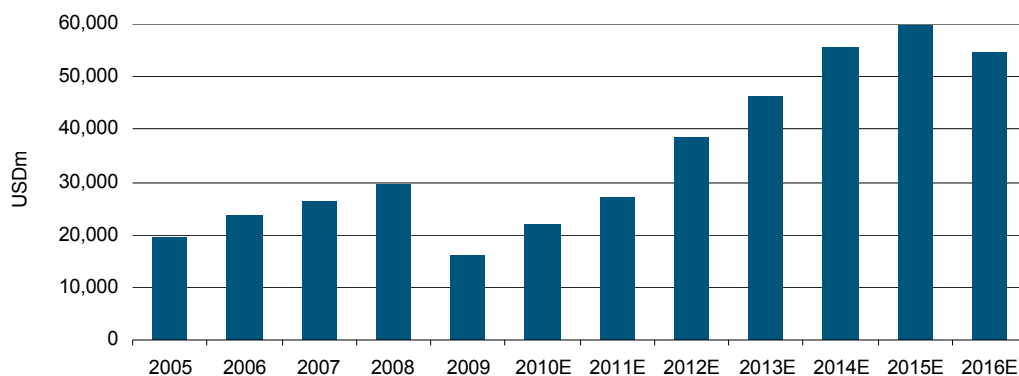
*New World booming ahead; economic growth monitored and policy induced*

Time will tell if the 'double dip' recession eventuates and foils our bullish outlook. That said, copper as well as thermal and coking coal have held up remarkably well amid the doom and gloom in the markets. Even iron ore at \$147/tonne is still a very good price, in our view, for an industry that has an average cash cost of less than \$40/tonne. In reality, demand does not need to be that strong for commodity prices to rise given that supply is very tight.

Even if China's growth slows to 8% in the second half, we think the authorities will carefully monitor the speed of the slowdown, which so far has been deliberate and policy-induced. Too steep a deceleration would likely bring a new stimulus package in Q4 and hence another boom in commodity prices. India, meanwhile, is humming along (some slowdown in June IP growth) and emerging powerhouses such as Brazil, Indonesia, the Philippines, Malaysia, Angola and Nigeria are firing on all cylinders. The decoupling of emerging markets from the old world this year has enabled commodities to perform surprisingly well. But even in the old world, German exports are booming and LA ports data is roaring in the US. Thus the risk, in our view, is more on the positive side. Our call is based more on supply rather than demand, however, because supply is where we have the greatest visibility.

## Mining capex accelerating again – buy the equipment suppliers

**Fig 1: Growth capex spent of iron ore, coal and copper projects (ex China)**



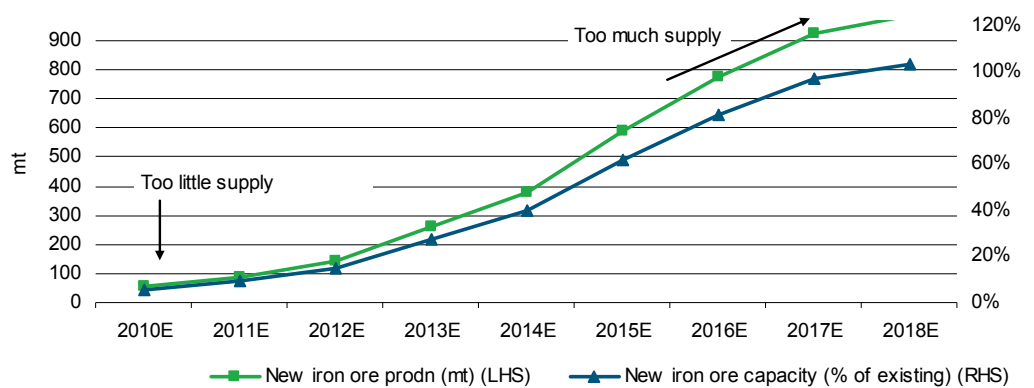
Note: Based on our analysis of nearly 800 iron ore, coking coal, thermal coal and copper projects.  
Source: Companies, Standard Chartered Research estimates

*Mining capex spend to peak at \$60bn; oversupply likely in 2015 as higher prices in the next three years could lead to start-ups of a plethora of new project*

Among the 238 live copper, coking coal, thermal coal and iron ore projects (ex China) worldwide, we estimate spending will peak by 2015 at \$60bn. Figure 1 illustrates the spending profile of copper, coking coal, thermal coal and iron ore projects. For commodity prices, most of this capex spend will not impact supply until 2015. However, there could be significant oversupply of iron ore and copper in 2015. But for now, the equity markets are not looking that far ahead, and as such, no one knows what demand will look like by 2015. Perhaps emerging giants such as Indonesia, Brazil, Malaysia, Angola and Nigeria will need much more raw material for their own consumption. By then, we think it may not just be an India and China story.



**Fig 2: Iron ore supply – too little near term and too much in the longer term?**



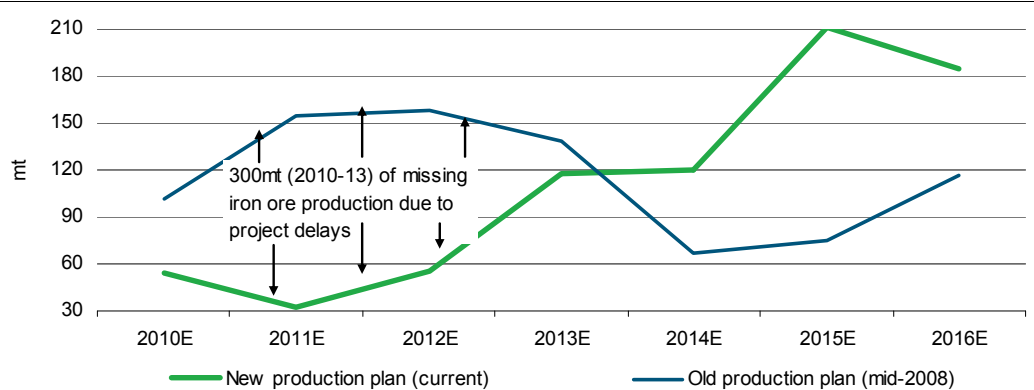
Source: Company, Standard Chartered Research estimates

### Iron ore prices could hit \$200/tonne in 2011

*Chinese steel producers could be on allocation next year as there is just not enough iron ore*

The 2008 financial crisis effectively delayed the addition of over 300m tonnes to new iron ore supply in 2010–15, as detailed in Figure 3. This leaves the industry looking very light on new capacity in 2011 and 2012. We estimate export supply growth of just 33m tonnes in 2011, which is a meagre 3.2% YoY growth in the seaborne market. If steel production grows by more than 4% in China (the average is 17%pa 2001-09) then there may not be enough iron ore supply next year, in our view. Ironically, the tight supply in both iron ore and coking coal could benefit China's steel industry as it could then enforce some discipline in an industry that lost its pricing power some three years ago due to oversupply.

**Fig 3: Iron ore supply forward curve – Old vs new production plans (YoY incremental capacity) (300mt missing near term)**



Source: Bloomberg forecasts, Standard Chartered Research estimates

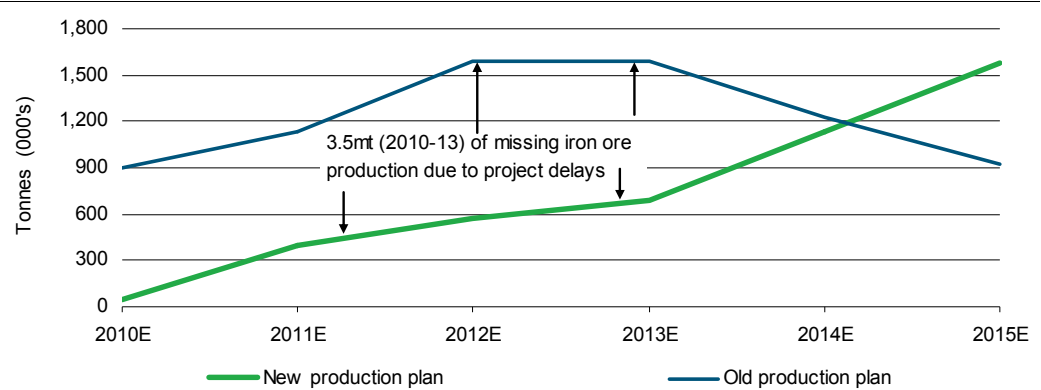
### Long end of copper curve could rally hard, contango even?

*Nearly 3.5mt of new copper capacity lost due to the 2008 financial crisis; copper price could spike to \$12,000/t if start-up issues are compounded by production slippages*

We have analysed over 236 proposed copper projects and found that 81 are likely to come onstream in the next 8 years. The 2008 financial crisis has effectively delayed some 3.5m tonnes of new supply for 2010–13, as detailed in Figure 4. The recent downward revision by Freeport of its Grasberg 2011 copper production target by 45,000 tonnes and BHP/Rio Tinto's Escondida by 50,000 tonnes has tightened supply even more. Even Xstrata missed its Q2 2010 copper production target by 6% or 26,000 tonnes. We estimate global copper supply will grow by only 0.9% in 2011 and we believe copper price could spike to \$12,000/tonne in the next 2 years. More importantly, the copper price forward curve looks set to rally on the long end.



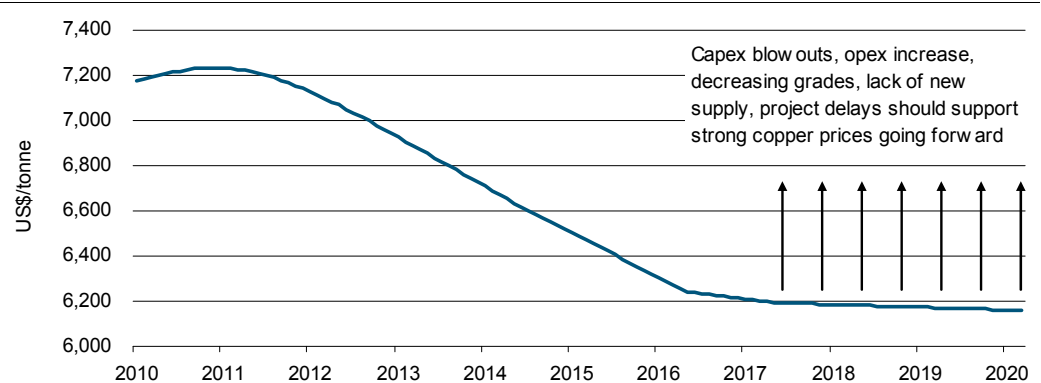
**Fig 4: Copper supply forward curve – Old vs new production plans (YoY incremental capacity) (3.5mt missing copper near term) -**



Sources: Standard Chartered Research estimates

This could end many years of backwardation in the market and we would not be surprised if it went into contango. This would have major ramifications on the valuation of copper shares, which have always laboured under the misapprehension by fund managers that copper price is set to fall by 20–30% in the next two years, given the shape of the price forward curve.

**Fig 5: Copper forward curve – from backwardation to contango?**



Source: Bloomberg, Standard Chartered Research estimates

## Thermal coal could head back to \$150/tonne

*Power-hungry China and India, coupled with weaker-than-expected Indonesian supply response likely to push thermal coal prices back towards \$150/t*

We believe thermal coal prices are on the verge of a major movement. Even assuming conservative growth in power-generating capacity in China and India, it is difficult to see how traditional thermal coal producers such as Indonesia and Australia can deliver enough supply. Mongolia appears to be a very exciting new coal province, but it lacks the infrastructure to deliver big tonnage into the China market. Mozambique is also potentially huge, but again, the rail and port infrastructure will take at least another 5 years to develop over and above the current capacity of 7m tonnes (presently devoted to coking coal).

We also believe growth in China’s domestic coal production – from 2.2bn tonnes in 2005 to over 3bn tonnes today – is unsustainable. Assuming conservative growth of 6% pa in China’s electricity generation to 1,240GW in 2015 (74% of which is coal fired) from 926GW in 2010, the country would need to find an additional 705m tonnes of coal. This is equivalent to adding five Australia’s or three Indonesia’s at current production levels. The supply requirement numbers are staggering, which leads us to believe that something needs to give. Our model assumes that 10% of all new power generation in China will need to source imported coal, which means that net imports will need to grow from 85m tonnes in 2010 to 147m tonnes by 2015. India has its



own big plans. Assuming power generation growth of 8%pa, we estimate India's net imports will grow from 73m tonnes to 143m tonnes over the same period. If India meets even half of its power generation targets, the era of cheap coal could be coming to an end. We see thermal coal prices heading back to \$150/tonne near term and \$200/tonnes medium term.

## Export coking coal prices could hit \$350/tonne in 2 years

*Mongolia likely a big winner in the near term as producers ramp up production in 2011 and 2012*

The seaborne market is likely to grow by only 9m tonnes in 2011, in our view. We expect nearly a third of this supply to come from Mongolia, from producers such as SouthGobi, Energy Resources and Mongolian Energy Corporation. The world's largest producer, BHP, has been running to a standstill in the last 5 years and will not bring on any new supply for another 5 years, in our view. The methane explosion at the Rospadskaya mine (7.7mt pa) in May has further exacerbated tightness in the market. A significant proportion of this production has been exported to Asia and the company said the mine will be back to full production by next year only. On the back of a near-term void in new supply and solid demand growth from China, we think coking coal prices could hit \$350/t in the next 2 years.

## Potentially positively situated

**Miners:** We believe coal, copper and iron ore producers could post record earnings in 2011 and 2012 based on our bullish commodity call. Our top picks among the mining companies are China Vanadium (893 HK, HKD2.69, O/P, FV HKD4.20, Yan Chen), China Shenhua (1088 HK, HKD28.4, O/P, FV HKD40.94), Yanzhou Coal (1171 HK, HKD17.84, O/P, FV HKD24.52, Yan Chen), and Hidili (1393 HK, HKD5.44, In-line, FV HKD6.19, Wei Ouyang). These companies stand out as they were steadfast in carrying out their project construction plans when most of the industry delayed or cancelled their plans post 2008 crisis.

Other companies that have announced they will be bringing on new capacity very soon include Antofagasta (ANTO LN, Not rated) in copper and Citic Pacific (267 HK, Not Rated) in iron ore, which has continued with the Sino Iron Project but is now close to being proven correct. Kumba Iron Ore's (KIO SJ, Not Rated, 67% owned by Anglo American) \$1bn Kolomela (Sishen South) project is another iron ore development that has continued to push ahead with development after the economic crisis of 2008 without any significant delays, as per company guidance.

South Gobi (1878 HK, Not Rated) and Mongolian Energy Corporation (276 HK, Not Rated) are exposed to rising coking coal prices. On Bloomberg consensus forecasts, Bumi Resources (BUMI IJ, Not Rated) is currently trading at 5.2x 2011 P/E. Philippine miner, Philex Mining Corporation (PX PM, Not Rated) could also benefit from higher copper prices.

**Mining equipment suppliers:** A rising capex environment may benefit mining equipment producers such as Sandvik (SAND SS, Not Rated), Atlas Copco (ATCOA SS, Not Rated), Sany Heavy Equipment (631 HK, HKD9.4, O/P, FV HKD11, JT Wu) – the Chinese coal mining equipment producer – and United Tractor (UNTR IJ, Not Rated) in Indonesia and Caterpillar (CAT US, Not Rated).

**The bulk shippers:** We think the the bulk shippers are well positioned for the longer term. It is becoming increasingly evident to us that consumers such as China and India will need to source further afield for their iron ore and coal supply. Our bulk shipping analyst, Claire Teng's favourite stock in this space is Pacific Basin (2343 HK, HKD5.4, O/P, FV HKD6.60, Claire Teng), which has successfully acquired many second-hand vessels at very cheap prices. The Handysize market also seems the most balanced. China Shipping Development (1138 HK, HKD11.4, O/P, FV HKD15.0, Claire Teng) is the largest coal carrier in China (coast-to-coast) moving coal from the Bohai region in Northern China to the Yangzi River delta and Guangdong Province.

**Alternative Energy:** If thermal coal continues to rally, the 'alternatives' are well positioned to benefit, in our view. GCL-Poly (3800 HK, Not Rated) is China's leading poly silicon maker for





solar panels. China Longyuan (916 HK, Not Rated) is one of China's major wind farm operators. China Everbright (257 HK, Not Rated) concentrates on waste to energy.

## Potentially negatively situated

**Regulated power:** Based on our \$150/tonne thermal coal price forecast, the Chinese IPPs will have to undertake major equity raisings or significantly increase power tariffs. Beijing may well attempt to clamp down on energy use and shut down 2,000 outdated factories, but it has tried these measures in the past with mixed results (largely due to the \$586bn stimulus package launched in 2008). Heavy industry accounts for half of the country's energy demand. To reflect Beijing's attempt to lower electricity intensity by 20%, we assume 6% growth in generation capacity. Even then, a surge in coal imports is likely, which would drive up seaborne coal prices. Net-net, we think Beijing's measures risk being late and the government's resolve would come at an expense of 2–3% of GDP growth. Near term, we would avoid the regulated power producers.

**Fig 6: Potentially positively situated companies**

Company	Bloomberg ticker	SC Rating	Listed currency	Share price	Market cap (USD m)	P/E (x)			EV/EBITDA (x)			P/B (x)		
						2010E	2011E	2012E	2010E	2011E	2012E	2010E	2011E	2012E
<b>Miners</b>														
Yanzhou Coal * (FV HKD24.52)	1171 HK	Outperform	HKD	17.5	12,671	9.5	7.9	7.7	5.9	5.1	5.0	2.0	1.7	1.5
China Shenhua * (FV HKD40.94)	1088 HK	Outperform	HKD	28.4	72,698	13.3	11.0	10.1	6.5	5.4	4.9	2.5	2.2	1.9
Hidili * (FV HKD6.19)	1393 HK	In-line	HKD	6.8	1,790	15.9	11.7	15.1	9.9	7.8	9.1	1.9	1.8	na
Gloucester Coal	GCL AU	Not rated	AUD	12.5	1,012	12.5	8.9	7.6	13.2	9.6	8.1	3.4	2.6	2.0
Adaro	ADRO IJ	Not rated	IDR	2,050	7,302	16.7	11.0	9.5	9.0	5.6	4.7	3.4	2.8	2.4
Bumi Resources	BUMI IJ	Not rated	IDR	1,490	3,141	8.7	5.2	5.3	4.9	3.6	3.4	1.6	1.3	1.1
South Gobi	SGQ CN	Not rated	CAD	12.4	2,177	na	30.6	12.3	105.1	15.4	7.1	4.5	4.0	3.0
Mongolian Energy Corp.	276 HK	Not rated	HKD	3.3	2,616	na	na	na	na	na	na	na	na	na
China Vanadium * (FV HKD4.2)	893 HK	Outperform	HKD	2.7	721	10.7	8.4	6.8	6.1	4.1	3.3	1.8	1.6	1.3
Citic Pacific	267 HK	Not rated	HKD	15.8	7,440	9.6	8.3	6.0	10.9	9.3	na	0.9	0.9	na
Kumba Iron Ore	KIO SJ	Not rated	ZAR	349.0	15,375	9.9	8.3	7.1	5.2	4.5	3.7	8.0	6.2	na
Atlas Iron	AGO AU	Not rated	AUD	2.1	856	na	4.8	3.3	na	2.8	1.4	2.7	1.8	1.2
MMX	MMXM3 BZ	Not rated	BRL	12.2	3,245	32.9	11.7	9.2	15.5	6.5	4.0	7.4	5.8	na
Antofagasta	ANTO LN	Not rated	GBP	10.0	15,293	9.3	6.2	6.1	5.0	3.5	3.5	1.8	1.8	na
Freeport McMoran	FCX US	Not rated	USD	70.6	33,196	9.8	8.5	8.4	4.5	4.0	3.8	2.7	2.1	1.8
Ivanhoe	IVN CN	Not rated	CAD	17.6	7,399	na	na	na	na	na	na	na	na	na
Philex Mining Corp	PX PM	Not rated	PHP	10.2	1,099	17.6	17.7	20.1	10.5	10.3	11.7	2.6	2.3	1.9
Sterlite Industries	STLT IN	Not rated	INR	160.6	11,536	3.5	9.7	7.3	na	na	na	0.4	1.3	1.1
<b>Average</b>						<b>12.9</b>	<b>10.6</b>	<b>8.9</b>	<b>15.2</b>	<b>6.5</b>	<b>5.3</b>	<b>3.0</b>	<b>2.5</b>	<b>1.7</b>
<b>Alternative Energy</b>														
China Longyuan	916 HK	Not Rated	HKD	8.6	8,258	31.1	21.4	17.8	11.2	8.4	6.8	2.4	1.9	1.8
China Everbright International	257 HK	Not Rated	HKD	3.7	1,718	28.3	21.7	19.4	15.8	12.7	12.2	3.7	3.2	na
GCL Poly	3800 HK	Not Rated	HKD	1.9	3,744	11.8	9.9	14.6	6.0	5.0	4.8	1.9	1.6	1.4
<b>Average</b>						<b>23.7</b>	<b>17.6</b>	<b>17.3</b>	<b>11.0</b>	<b>8.7</b>	<b>7.9</b>	<b>2.7</b>	<b>2.2</b>	<b>1.6</b>
<b>Equipment suppliers</b>														
Sandvik	SAND SS	Not rated	SEK	90.4	14,540	16.3	11.9	9.9	8.8	4.3	3.8	3.2	2.6	2.3
Atlas Copco	ATCOA SS	Not rated	SEK	115.9	19,099	15.5	13.3	11.9	9.0	7.8	7.1	4.6	3.8	3.2
Sany Heavy * (FV HKD11)	631 HK	Outperform	HKD	9.4	2,503	29.8	19.0	16.0	25.2	18.1	13.8	3.7	3.1	2.3
United Tractors	UNTR IJ	Not rated	IDR	18,800	6,942	15.0	13.0	12.4	7.7	6.6	5.9	3.8	3.2	2.7
Caterpillar	CAT US	Not rated	USD	67.5	42,557	21.1	14.2	10.1	12.6	9.9	2.0	4.3	3.5	2.7
<b>Average</b>						<b>19.0</b>	<b>14.1</b>	<b>13.2</b>	<b>11.5</b>	<b>8.6</b>	<b>6.5</b>	<b>3.4</b>	<b>2.9</b>	<b>2.3</b>
<b>Bulk shippers</b>														
Pacific Basin * (FV HKD6.60)	2343 HK	Outperform	HKD	5.4	1,328	14.3	11.7	7.8	8.1	5.7	4.2	1.0	0.9	0.9
Tianjin Port * (FV HKD3.90)	3382 HK	Outperform	HKD	1.8	414	11.8	9.6	7.9	5.9	4.8	4.1	0.8	0.7	0.7
China Shipping Devpt * (FV HKD15.0)	1138 HK	Outperform	HKD	11.4	4,993	15.1	10.4	9.3	5.1	2.9	2.7	1.3	1.1	1.0
<b>Average</b>						<b>13.7</b>	<b>10.6</b>	<b>8.4</b>	<b>6.4</b>	<b>4.5</b>	<b>3.7</b>	<b>1.0</b>	<b>0.9</b>	<b>0.9</b>

FV – Fair value estimates

Priced at Hong Kong close on 17 August 2010

\* - SC estimates; others – Bloomberg consensus estimates

Source: Bloomberg, Standard Chartered Research estimates



## 2008: Planting the seeds for the next bull market

- Nearly \$200bn worth of projects cancelled or suspended due to the financial crisis in 2008.
- M&A activity in 2007/8 distracted CEOs from developing organic growth projects.
- Most mining companies did not build significantly in the 2004–8 bull market anyway.
- Dormant projects still lying dormant. Lack of bank lending. Equity financing impossible for start-ups.
- Buying capacity still seems more attractive than building. Equity valuations too cheap.

To understand why the 2008 liquidity crisis is so important, just look at the 1997 Asian contagion. We firmly believe the 1997 collapse was the primary catalyst for the 2003–8 commodity bull market. Why? Because few in the industry built mines for the five years after the 1997 crisis. As a result, when China awoke in 2002, the producers were not ready. In 1997, commodity prices collapsed to all-time lows in real terms. Copper plunged to \$0.68/pound and 1999 was the only year in the past two decades when iron ore producers settled for a 12% cut in prices. The mining industry responded by cutting costs, buying back shares and freezing all capex.

### Equity markets frowned upon growth

*Miners were too late to respond to the commodities boom in 2004–05; they went on an M&A hunt in 2006–08, which led to further underinvestment in new projects*

After the 1997 Asian contagion, growth in the mining industry became a bad word and the industry was viewed by the markets as undisciplined and irrational. When China Steel announced a capacity expansion at its Kaohsiung plant in 2002, its share price fell 35%. Two weeks later, management changed its decision and introduced a high dividend policy at the expense of organic growth. At the same time, CEOs of the mining companies were slow to wake up to China. Surprisingly, even when China began to impact commodity prices in 2003–4, many mining CEOs were still wary about building new capacity. They had vivid memories of the 1998 downturn and were not prepared to consider M&A or organic growth. Xstrata in the UK took the opposite view and aggressively grew by buying higher-cost operations. Soon Xstrata's investments in companies such as MIM and Falconbridge were viewed as a masterstroke because rising copper and nickel prices meant that these acquisitions were quickly paid off from healthy cashflow. By 2005, Xstrata/Glencore management was considered one of the smartest in the industry and many investors would berate companies such as Rio Tinto for their more conservative views on growth through M&A.

### But by 2006, mining CEOs were bullish

By 2006, growth through acquisition and increased capex became the norm. Companies like Teck Cominco, Xstrata and Rio Tinto leveraged up their balance sheets through acquisitions. Suddenly managements would boast of their expansion plans in iron ore, copper and coal projects and then compare themselves with the peer group. The iron ore producers were probably the most bullish. Vale made claims it could grow from 250mt to 500mt. BHP, Rio Tinto and Fortescue said they could add 600 million tonnes between them. In total, if you believed the hype, we were going to see over 850 million tonnes of new capacity enter the market by 2014, which at the time represented a 100% increase in seaborne traded iron ore capacity. Fortunately, most of this was severely delayed by the 2008 financial crisis.

### Xstrata/Glencore's rejection of Vale's offer was a flashing red light

When one of the smartest management teams in the business turned down a hefty offer of £26/share (ex-rights issue) in August 2008, this was perhaps a sign. When the crash came, Xstrata's share price fell from £25 to less than £3 (prices ex-rights issue). Rio Tinto, with a once unblemished balance sheet, suffered a share price collapse and, for a while, it seemed Teck Cominco was close to bankruptcy. The industry was in shock and there were project cancellations all round. Surprisingly, Vale and BHP, which had the two strongest balance sheets did not use the downturn to pick up cheap assets. Instead, the whole industry stalled overnight.

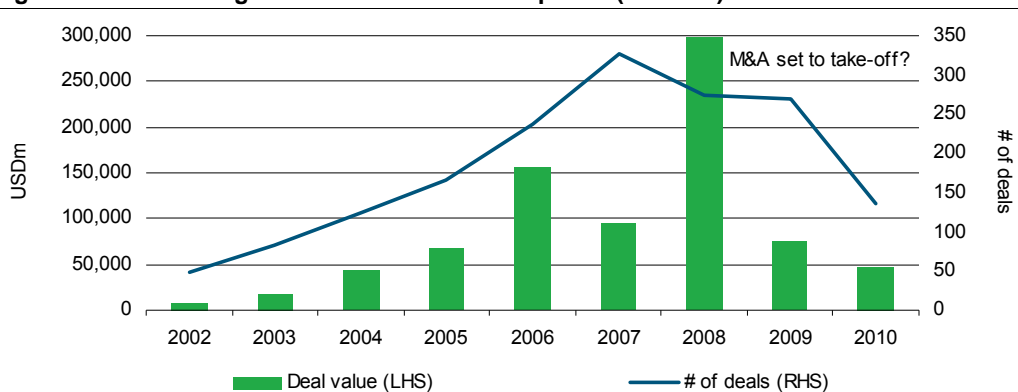


Deeply discounted rights issues became all the rage to shore up many of the more stretched balance sheets and suddenly the ‘build, build, build’ mentality was no more.

### Even during the good times, M&A meant companies did not build

We would argue that the failed hostile bids from BHP for Rio Tinto and from Vale for Xstrata meant managements were spending too much time talking to investment bankers in late 2007 and 2008 and not focusing enough time on building new mines. There was a lot of ‘talking the talk’ about growth in new mines, but very little ‘walking the walk’. This we believe is another positive for the sector today, because when some of the biggest players in the industry had the balance sheets to build mines, they did not as they were busy thinking of growth through M&A. This may partly be because they knew then, as they know now, that it is still cheaper to buy existing capacity than to build it. In reality, building a new mine takes up to 10 years from the point of discovery and by the time they come onstream, who knows where the commodity price will be?

**Fig 7: Value of mining deals announced or completed (2002–10)**



Source: Standard Chartered Research

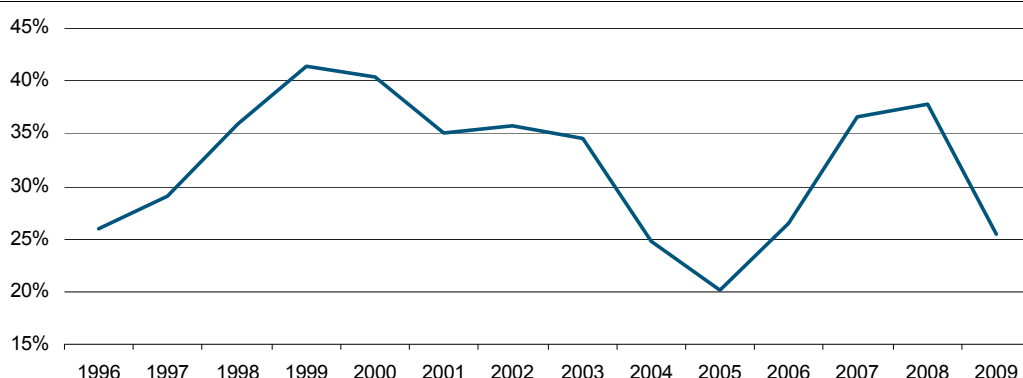
### Since the crash, the industry has been slow to resume projects

Since the 1997 financial crash, the industry has been slow to resume projects, despite the fact that copper and iron ore prices are within 10–20% of their all-time highs. It seems that the mining industry was not only caught out on the way down, but also on the way up, when the mid-2009 rally took hold. When the recent PIG (Portugal, Italy and Greece) euro crisis took hold in May and June 2010, the mining companies were once again wondering if the global economy was about to enter a ‘double dip’ recession. All in all, luck has favoured the brave. Right now, there is much talk about starting up projects, but most of these are still subject to the completion of lengthy feasibility studies. No doubt, if we are proven right and commodities do rally, the companies could accelerate the projects. This is why we believe that from 2015 onwards, the industry may be faced with oversupply, but right now, the equity markets are focused only on 2011 and 2012, which we think could be very strong.

### But with balance sheets repaired we may be entering a period of heightened M&A activity

Thanks to rising commodity prices and deeply discounted rights issues in early 2009, the balance sheets of the industry have improved dramatically as illustrated in Figure 8 below. In reality, M&A has proven to be a much faster and almost a cheaper route than to build long-dated greenfield projects. The other problem is that the cost of building new projects is accelerating.

*Gearing of miners near its lows; M&A rush again?*

**Fig 8: Miners – Average gearing (%) since 1996**

Note: Average gearing of BHP Billiton, Vale, Rio Tinto, Xstrata, Anglo American, Freeport, Teck Resources  
Source: Company, Standard Chartered Research

## Rising costs a big deterrent for new projects

We estimate the cost of building a copper mine has risen by over 100% in the past 5 years. Developing low-grade, copper ore bodies is an expensive business in Latin America and we believe producers need at least \$2.80/pound long-term price to justify a 20% IRR. The same is true for iron ore and coal. Cost overruns on iron projects in Australia of 30–40% in the past four years are the norm, rather than the exception.

## Buying capacity is better than building it, in our view

We believe that buying an existing producer makes more commercial sense than building a copper mine today as the price differential between the two is almost negligible. The cost to build a greenfield copper mine today is around \$13,000/tonne (\$13,382/tonne to be exact) of annual capacity – for the average porphyry low grade copper/gold project in countries such as Chile, Peru, Indonesia or the Philippines. On the flipside, if a company wants to buy an existing copper producer to avoid the hassle involved with building a new mine that most likely will not come onstream until 2015, then it would cost only about \$19,000/tonne assuming a 25% takeover premium. This does not make sense to us and illustrates how relatively cheap mining equity is today and possible inefficient pricing. We believe it should trade at a premium of least 2 to 3 times to the cost of building. But today, excluding the 25% takeover premium, it is trading close to replacement cost. Heightened M&A activity could return, in a repeat of the 2007/8 scenario. Already, BHP is showing signs of this with its hostile bid for Potash Corp on August 17.

*Why build a copper mine when you can buy an existing producer for only a little more?*

**Fig 9: Copper – Buy vs build (in copper equivalent)**

Company	EV (in \$m)	2010 prodn (Cu eq.)	EV/production (\$/t Cu. eq)
Anglo American	63,892	5,300	12,055
BHP Billiton	185,006	10,013	18,477
Rio Tinto	128,272	10,011	12,813
Xstrata	60,623	4,612	13,145
Antofagasta	14,728	426	34,534
ENRC	19,547	1,094	17,862
Kazakhmys	12,074	597	20,226
Freeport	36,899	2,265	16,292
First Quantum	5,439	405	13,417
Vedanta	13,373	936	14,287
<b>Total/Average</b>	<b>539,853</b>	<b>35,660</b>	<b>15,139</b>
<b>Potential cost of acquisition after 25% takeover premium</b>			<b>18,924</b>

	Total capex (\$m)	New copper capacity (kt)	Avg. cost to build per tonne (\$/t)
New copper projects	123,318	9,215	13,382
<b>Acquisition premium over building a new mine</b>			<b>41%</b>

Source: Companies, Standard Chartered Research

We also believe that the 'buy vs build' case is relatively better for iron ore than for copper as iron ore companies are trading at roughly 1.8x of the average iron ore project cost, which is still below the norm of 2–3 times of replacement cost. We still believe that there will be a surge in the M&A market, however, despite the price gap between cost of buying and building as China's industry players are likely to step up their acquisitions of iron ore assets abroad to reduce their dependency on the Big 3 for quality iron ore. Steel makers such as Arcelor Mittal, Tata Steel and CSN have also indicated that they are keen to reduce their dependency on third parties for iron ore and to try to secure future raw material supplies. The Indian consortia are also awash with cash to acquire thermal coal projects in Indonesia, Mozambique and Australia. Do they see something the equity markets cannot see right now: commodity price inflation?

**Fig 10: Iron ore – Buy vs build (in iron ore equivalent)**

Company	EV (in \$m)	2010 prodn (Iron ore eq.)	EV/production (\$/t iron ore Eq)
Anglo American	63,892	389	164
BHP Billiton	185,006	736	251
Rio Tinto	128,272	736	174
Xstrata	60,623	339	179
Vale	153,481	658	233
Fortescue	16,261	55	296
Ferrexpo	3,260	13	261
Kumba Iron ore	16,678	46	362
ENRC	19,547	80	243
Vedanta	13,373	69	194
<b>Average</b>	<b>660,394</b>	<b>3,121</b>	<b>212</b>
<b>Potential cost of acquisition after 25% takeover premium</b>			<b>265</b>

	Total capex (\$m)	New iron ore capacity (kt)	Avg. cost to build per tonne (\$/t)
New Iron ore projects	105,109	920	114
<b>Acquisition premium over building a new mine</b>			<b>132%</b>

Source: Company, Standard Chartered Research



*Funding is scarce for the small miners as regional (Africa, etc) and balance sheet risks are a concern to lenders*

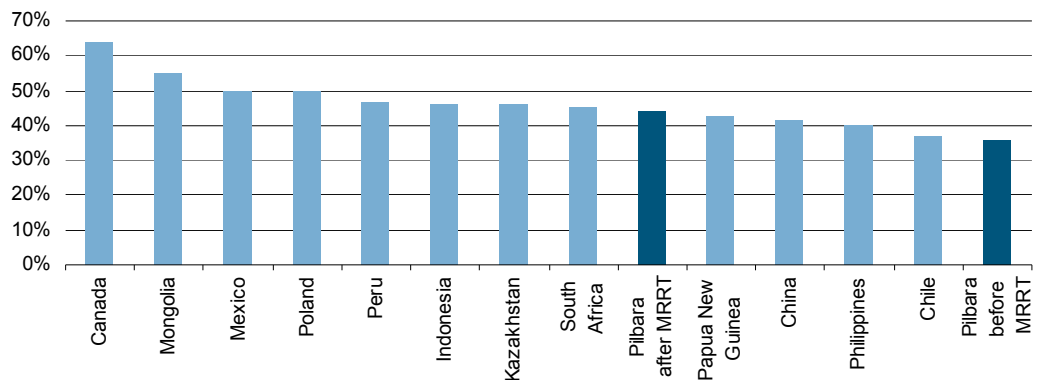
## Single project miners struggle to raise equity financing

Despite the rally in commodities, small companies still find it difficult to raise money to build the projects they planned before the crash. The main reason for this is that the share price of small-cap stocks fell more than others during the global meltdown – most by 90% from their mid-2008 highs, and investors still have memories of this. Western banks are reluctant to lend to the smaller projects (especially in Africa) and equity markets are nervous about financing mines that are more than two years away from being cashflow generative. Only the Hong Kong market seems able to gain financing for the start-up mines at the moment. Recently, CST Mining Group raised nearly \$600bn to finance the acquisition of Lady Annie in Australia and develop its copper project in Peru, which will begin production in four years. This kind of equity financing is currently rare in the more traditional markets of Australia, London or Toronto. If we are on the verge of another major bull market, then we believe equity markets should be more supportive of single project miners. But they are not presently, and this, in our view, is another catalyst likely to push commodity prices higher.

## Higher taxes announced in Australia do not help

The Australian mining industry reacted en masse to the announced 40% 'Super Tax' in May this year. Figure 11 shows Australia's ranking if its revised 30% super tax on iron ore and coal producers were passed by the Australian parliament. Assuming the introduction of the super tax, Australia would become a mid-tier taxer from being one of the lowest of the mining industry. Interestingly, many of the Australian miners who were most vocal about the effect of the tax and its impact on their projects were the same companies that were forced to delay their projects the most because of the 2008 financial crisis. The reality is that the direction of commodity prices will decide the fortunes of most of Australia's future mining projects, not a tax issue. At today's elevated prices for iron ore and coal, just about any project makes sense under whatever tax scheme the Australian government decides to introduce.

**Fig 11: Effective tax rates in major mining regions**



Source: Companies, Standard Chartered Research estimates

## Environmental issues are a bigger bottleneck than tax issues

The best example is Vale's Carajas Serra Sul 'S11D', which has the potential to produce 90m tonnes at a capex of \$11.3bn. In early 2008, Vale said Serra Sul would be one of the largest greenfield iron ore projects ever developed with first production scheduled for the first half of 2013. Recently, Vale announced that the project is still subject to obtaining the environmental licences and board approval, and should start production in the second half of 2013. Clearly, it is going to be increasingly difficult for Serra Sul to hit a 2H13 startup target given the scale of this project. We think the first production from Serra Sul is likely to slip into 2014 as it awaits environmental permits.

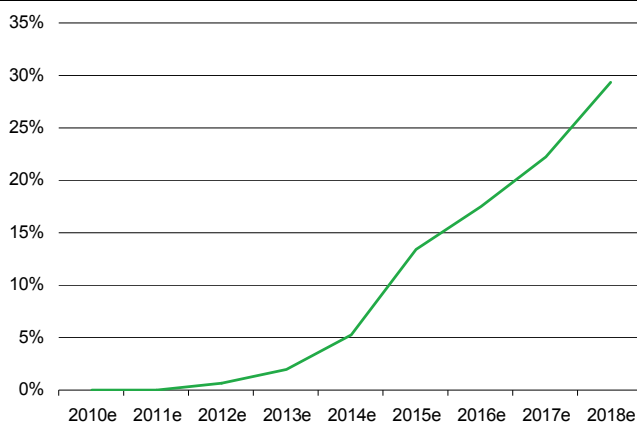


## New mining frontiers are taking much longer to come onstream

*New mining frontiers such as Western Africa and Mongolia could be key to supply responses, but only in the longer term*

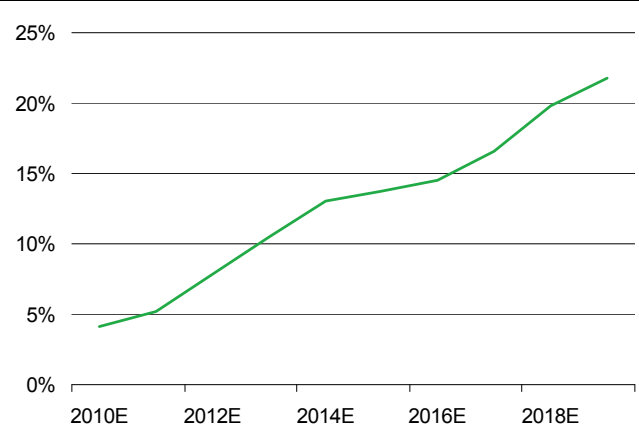
“Go West, young man” has been the cry of Vale and Rio Tinto in recent months as they race to develop different parts of the world class Simandou iron ore project in Guinea. Just how quickly these projects will come onstream is a big question mark. Northwestern Africa is a potentially huge iron ore province. Today, however, production out of Sierra Leone, Liberia and Guinea is less than 1m tonnes. In reality, the scale of the resources in these countries and the richness of these orebodies mean that this region should be delivering some 200m tonnes to the market. The beauty of Western Africa is that it is much closer to Europe than Brazil. But building large-scale iron ore mines in these countries will take time. The most advanced of the significant projects is African Minerals, run by Alan Wattling out of the Fortescue stable in Australia. We think this is a very exciting project, but it is unlikely to start first production of its initial 8m tonnes of hematite capacity until late 2011. Rio Tinto has now teamed up with Chalco to develop Simandou. Chalco will commit the first \$1.35bn of capex and the scale of the project ranges 40m–70m tonnes, depending on its rail options. While it is great news for Rio Tinto that it now has a Chinese financier, the project is still likely to take at least five years to come into production. Vale has also teamed up with BSG Resources to develop Blocks 1 + 2 of Simandou, and Vale is talking openly about building a world-class operation and railing through Liberia. Figures 12 and 13 illustrate the likely impact of West African projects on future global seaborne iron ore trade. By 2018, they could represent 30% of total new iron ore capacity, by our estimates.

**Fig 12: New iron ore production from West Africa as a % of total seaborne supply**



Source: Standard Chartered Research estimates

**Fig 13: New coking coal production from Mongolia and Mozambique as a % of total seaborne supply**



Source: Standard Chartered Research estimates

## Mozambique is massive, but has infrastructure issues

On paper, the Tete coal province is another region that could easily produce 100m tonnes of high-grade thermal coal and at least 20m tonnes of coking coal. The problem is that its rail capacity is only 7m tonnes and the port at Beira is not yet finished. Now Vale wants to rail its coal in the longer term to Nacala via Malawi. In reality, this is going to take another five years to develop. So, in the meantime, Tete will likely remain a small but highly profitable coking coal producer, leaving billions and billions of tonnes of thermal coal with seams up to 60 metres thick lying idle.



## **Mongolia is also key for coal and copper**

Mongolia's coal resources are potentially enormous and we believe the country is arguably the most exciting new mining frontier in the world today, especially with regard to copper and coking coal. Ivanhoe's and Rio Tinto's Oyu Tolgoi is the first major new greenfield copper mine that the industry has developed since Alumberra in 1997. This illustrates how slow the copper industry is in developing major new mines. In coal, Mongolia exports some 10m tonnes of semi soft and coking coal into China. Production is likely to increase by another 10–15m tonnes over the next three years, making it the largest new supply of higher-grade coal. Time will tell if producers such as South Gobi, Energy Resources and Mongolian Energy Corporation can deliver their promised tonnage using trucks. The cost advantage to Chinese steel producers of importing coking coal from Mongolia is still compelling, in our view, compared with buying it from Australia.

## **Old world underperforming – new world a long way off**

In short, the old world is underperforming and the new world is at least five years away from bringing on big tonnage. This is why we believe the commodity market is set for substantial bull run. It is that simple – supply, supply, supply. Part of the problem lies with the perceived comfort zones of mining CEOs, such as Australia where the potential political risks are lower. Until Africa and Mongolia works, global supply will remain constrained and commodity prices should continue to rise over the next five years. Only a major global economic slowdown would stop this, in our view.

## **Do not get caught short watching Chinese lending**

Since the commodities bull market began in late 2002, the equity markets have become obsessed by China's lending swings. The general trading pattern is to buy commodities when the taps are on and sell when they are off. This is far too simplistic, in our view, and investors should be wary about looking only at demand drivers such as Chinese lending. The Chinese authorities have done a very good job of maintaining economic growth of 8–10%. Markets love simple numbers and Chinese lending is an easy one for sales traders to talk about on Bloomberg. The more difficult conversation, however, comes from exploring supply and how much is really coming onstream. This approach requires a lot more work. In this report, we analyse nearly 800 projects and while we cannot be sure we are right on every one, it is the trend that is important – we believe these projects will take a lot longer to come onstream because of the 2008 global meltdown.





## Iron ore – Shortages in 2011?

- No significant new projects in the near term; 300mt of new capacity pushed out from 2014.
- Rio Tinto's acquisition of Alcan in 2008 has added \$30/tonne to iron ore price today?
- West Africa has huge potential but there are also huge infrastructure issues.
- The Brazilian and Indian governments want miners to retain ores in country and produce steel.
- Will too many projects come into production from 2014 causing a traffic jam of new mines?
- We anticipate prices heading back to \$200 per tonne over next 12 months.

Iron ore producers were hit the hardest by the 2008 crisis. From September 2008 to February 2009, most were forced to shut down as much as 50% of their existing capacity. Shipments bound for China were turned away and capesize boats sat off Chinese ports for months, the country's steel producers were awash with iron ore inventory and steel prices were falling. In this kind of environment, it is easy to see why many projects were quickly forgotten by management teams, whose focus was more on staying alive than building new mines. Almost overnight, some 300m tonnes of potential new projects were cancelled or postponed.

**Fig 14: Iron ore supply and demand**

(m tonnes)	Standard Chartered forecasts						
	2009	2010E	2011E	2012E	2013E	2014E	2015E
<b>Seaborne supply</b>							
Australia	408	422	447	487	541	601	700
Brazil	260	297	309	318	366	405	458
India	122	122	122	125	137	147	147
South Africa	41	49	50	52	60	61	62
ROW	124	119	115	115	112	121	180
<b>Global</b>	<b>955</b>	<b>1,010</b>	<b>1,042</b>	<b>1,097</b>	<b>1,215</b>	<b>1,335</b>	<b>1,547</b>
<i>yoy growth (%)</i>		5.7%	3.2%	5.3%	10.8%	9.9%	15.8%
<i>yoy growth (mt)</i>		55	33	55	118	120	212
<b>Seaborne demand</b>							
China	625	663	699	734	771	813	858
Europe	128	146	150	155	159	164	169
Japan	104	112	116	119	123	126	130
Korea	37	39	41	43	45	47	50
Taiwan	12	13	13	13	13	13	13
ROW	40	77	103	108	119	127	135
<b>Global</b>	<b>946</b>	<b>1,049</b>	<b>1,122</b>	<b>1,172</b>	<b>1,230</b>	<b>1,291</b>	<b>1,355</b>
<i>yoy growth (%)</i>		10.9%	6.9%	4.5%	4.9%	5.0%	5.0%
<i>yoy growth (mt)</i>		103	73	50	58	61	64
<b>Surplus/ (Deficit)</b>	<b>9</b>	<b>(39)</b>	<b>(79)</b>	<b>(74)</b>	<b>(14)</b>	<b>44</b>	<b>192</b>

Source: Standard Chartered Research estimates

### Most projects delayed by two years

The net effect is that projects that were planned for development before the 2008 crash are now delayed by around two years. Figure 15 illustrates how the 2008 financial crisis has impacted near-term supply. Three years ago, before the Bear Stearns meltdown, we had expected supply to grow by some 102m tonnes in 2010, representing 11% growth. Today, we would be lucky to witness growth of 36m tonnes from new projects (excluding 20m tonnes of incremental production from production restarts). That is a 66m tonne shortfall. We do not expect the situation

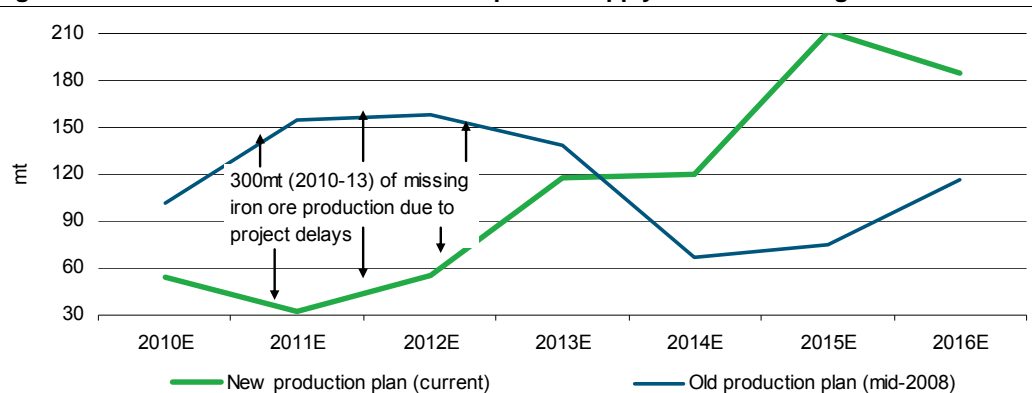


to have improved in 2011. Three years ago, the industry was hoping to deliver up to 155m tonnes of new mine supply. Today, a realistic number would be around 33m tonnes only.

*Iron ore industry has lost 300mt of new iron ore capacity in the next 3 years (till 2013) due to the 2008 financial crisis*

Looking ahead, we believe the industry could be in oversupply from 2014 as many of the larger projects should have come onstream by then. For now, we do not think the equity markets will look that far ahead, especially given the chance that many of these projects will face delays. For now, we look for a very tight market over the next 24 months. If Chinese steel producers attempt to grow production by 5% next year, there may not be enough iron ore to go around. In fact, we believe that next year could be the first year on record when Chinese steel producers will not be able to achieve their production targets, given an expected iron ore shortage. Ironically, this could be good for the industry as steel shortages will reduce exports and may even prompt imports from Europe, now enjoying the benefits of the weaker Euro.

**Fig 15: How the 2008 financial crisis has impacted supply – 300mt missing near term**

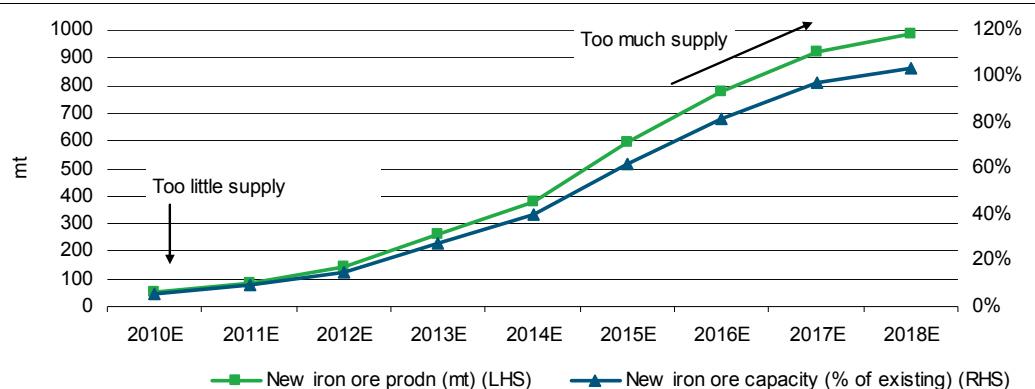


Source: Standard Chartered Research estimates

### Too many projects coming on after 2014?

*Addition of only 38mt of new iron ore capacity in 2010 compared with 100mt before the financial crisis*

An effect of the 2008 financial crisis is that it has created a traffic jam of new projects now hitting the market in 2014. This is why we think investors should now look to companies that can reap the benefits of new capacity. Even Citic Pacific, whose share price has suffered for its cost overruns, could actually prove successful in delivering capacity 2–3 years ahead of the competition. The question in our mind is why didn't the iron ore companies build during the downturn, and why are they now looking to join a growing list of producers who will swamp the market post 2014? Timing is everything and those delivering new supply into what we think will be a hot market in 2011 and 2012 is likely to perform the best. Victims of the crash – like Rio Tinto, which seems to be adding capacity only post 2015 in both Australia and Guinea – may not reap the same kind of benefit. Sometimes a deal such as that involving Alcan can impact the share price longer than anticipated.

**Fig 16: Iron ore supply – Too little in the near term and too much in the longer term?**

Source: Bloomberg, Standard Chartered Research

### Why is it so hard to bring on new iron ore supply today?

Apart from the sheer scale of iron ore projects and their capital-intensive nature, the reality is that delivering an iron ore project in today's environment is a lot more difficult than it was two years ago before the crash. This is for two reasons. First, funding restraints are only just beginning to ease for the juniors, and even companies like Rio Tinto were distracted in the past 18 months paying down debt. Second, the difficulty of securing an offtake partner in China is only just easing after last year, when many such steel producers were turning away iron ore shipments and reneging on contracts.

### Mines likely to run at 90% of capacity, at best

One of the most important aspects of iron ore is that most mines get only about 11 months of production each year. Output is invariably impacted by factors such as rainstorms, typhoons, strikes, delays at ports and equipment failure. When assessing headline capacity numbers from producers, we estimate that a reduction of about 10% is prudent. As the industry tries to squeeze every tonne out of the system today and given the surge in prices, production slippage at existing mines is almost certain.

### All of the idled capacity from late 2008 is now back onstream

With the surge in prices this year, very few mines are operating at their full capacities. After the 2008 crash, most were forced to shut 50% of their production as they could not find a market to sell their iron ore. Capacity has steadily increased since Q209 and we estimate production hit full capacity around April this year, when the higher benchmark price took effect. Hence, we believe there is no flexibility in the industry to deliver more tonnage.

### Chinese domestic iron ore producers not able to fill the void?

We believe China is unlikely to satisfy its own iron ore need by growing its domestic production because its iron ore mines are typically quite small (average mine production = c.100kt/pa. in 2009) and of low grade (c.33% national average).

China's top 10 iron ore producers – including those owned by companies such as Angang (0347.HK; OUTPERFORM; last close HK\$13.26, fair value HK\$14.39, Wei Ou Yang), Hebei Steel and Panzhihua Steel – account for only 22% of the country's total iron ore production of some 262m tonnes, well short of its annual steel production of 640m tonnes this year.

**Fig 17: Top 10 iron ore producers in China control only 22% of the market (2009)**

Company	Location	Iron in concentrate (kt)
Anshan Steel	Liaoning	15,795
Hebei Steel Group	Hebei	5,161
Panzhihua Steel	Sichuan	6,944
Benxi Steel	Liaoning	6,421
Taiyuan Steel	Shanxi	5,395
Baotou Steel	Inner Mongolia	4,886
Maanshan Steel	Anhui	n.a.
Shougang	Hebei	4,854
Hanxing	Hebei	2,757
Wuhan Steel	Hubei	4,003
Jiuquan Steel	Gansu	3,188
<b>Total top ten major producers*</b>		<b>59,404</b>
<b>Total China</b>		<b>262,400</b>

\* Major producers refer to members of the CISA with the largest volumes of iron ore output. All of the major iron ore producers listed are stated owned.

Source: MMAC, CISA and Hatch estimates

## China's foreign investments likely to have little impact near term

*Today, China is likely to source only 6% of its iron ore import needs from foreign investments; growing to 14% by 2015*

Given China's relative weakness in iron ore production, participants are now aggressively seeking to gain control/interest of foreign-owned iron ore projects and mines, but we believe this will barely move the dial in the near term. In 2010, we estimate China-owned or partly-owned mines outside the country will produce just 36m tonnes of an estimated 663m tonnes of imports. As production steadily grows from such entities, we estimate China-owned production will increase to 134m tonnes by 2015. This is only 16% of an import requirement that we estimate will be at 858m tonnes. At today's spot prices, we project China will import about \$130bn worth of crude oil, \$90bn of iron ore and \$35bn of copper this year. This is equivalent to about \$700m in total every day for these three commodities, which are by far the largest components of commodity imports into China.

Chinese companies have invested over \$25bn in acquiring stakes in 19 iron ore start-ups and producers over the past three years. The largest of these acquisitions are Chinalco's 9% stake in Rio Tinto for \$14bn and Hunan Valin's 17.3% holding in Fortescue for \$771m. Some companies, like China Metallurgical Corp, Citic Pacific and Sinosteel have gone it alone and secured 100% ownership of actual deposits, while others have preferred to form a JV with existing promoters to develop mines, as listed in Figure 18.

In all cases, the Chinese entities have provided the financing for the projects, which has proved to attract the Australian, Brazilian and now West African start-ups. We think Citic Pacific's new Sino Iron project is the most courageous so far, as they continued to build during the financial crisis and it should hit full capacity of 25 million tonnes by 2014 based on company guidance. Its capex has increased from \$4.0bn to close to \$6.0bn, but we think it is a quality project and by far the largest 100% China-owned investment in copper, zinc, coal, oil or iron ore outside the country.

**Fig 18: Chinese investments in foreign iron ore assets**

Project (Company)	Chinese company	Country	Chinese	Grade	2010E	2011E	2012E	2013E	2014E	2015E
Simandou (Rio Tinto)	Chalco	Guinea	45%	66%	-	-	-	-	-	10
Sino Iron project (Citic / MCC)	Citic / MCC	Australia	100%	66%	-	3	10	18	25	25
Cape Lambert (China Met Corp)	China Met Corp	Australia	100%	58%	-	-	-	-	-	2
West Pilbara (Aquila/Metal & Coal)	Baosteel	Australia	100%	58%	-	-	-	-	5	25
Cloudbreak 40mt (Fortescue)	Hunan Valin 17% in FMG	Australia	17%	58%	0	5	10	15	20	40
Chichester Hub 40mt (Fortescue)	Hunan Valin 17% in FMG	Australia	17%	58%	40	40	40	40	40	40
Chichester Hub 55mt (Fortescue)	Hunan Valin 17% in FMG	Australia	17%	58%	-	5	12	15	15	15
Chichester Hub 95mt (Fortescue)	Hunan Valin 17% in FMG	Australia	17%	58%	-	-	-	5	20	30
Pilbara (Rio Tinto)	Chinalco 9% in Rio Tinto	Australia	9%	58%	220	230	230	230	235	255
Karara Magnetite (Gindalbie)	Anshan Iron	Australia	68%	36%	-	1	6	9	11	11
Savage River (Grange Resources)	Shagang	Australia	60%	58%	2	2	3	3	3	3
Southdown (Grange Resources)	Shagang	Australia	60%	37%	-	-	-	-	1	7
Weld Range (Midwest / Sino Steel)	Sinosteel	Australia	100%	59%	-	-	-	-	2	5
Sheep Hill / Wilgerup (Centrex)	WISCO/Batou	Australia	67%	59%	-	-	-	-	-	3
Mt Newman JV (BHP)	Wisco/Maanshan etc	Australia	7%	58%	120	120	120	120	127	134
Extension hills/Koolan Island (Mt Gibson)	China Railway / Shandong	Australia	34%	60%	1	2	4	4	4	4
Serra Azul (MMX)	WISCO 9% in MMX	Brazil	9%	41%	9	11	12	13	17	17
Bom Successo (MMX)	WISCO 9% in MMX	Brazil	9%	41%	-	-	-	-	2	10
Chile (MMX)	WISCO 9% in MMX	Chile	9%	30%	-	-	-	-	-	1
Tonkolili (African Minerals)	China Railway / Shandong	S Leone	40%	29%	-	-	3	8	13	23
Itaminas CdM (East China)	East China	Brazil	100%	38%	3	3	3	3	3	3
Kalia (Bellzone Minerals)	China Int Fund	Guinea	50%	62%	-	-	-	-	-	10
<b>Chinese equity share in production</b>					<b>36</b>	<b>42</b>	<b>55</b>	<b>68</b>	<b>88</b>	<b>134</b>
<b>Chinese Imports (SC forecast)</b>					<b>663</b>	<b>699</b>	<b>734</b>	<b>771</b>	<b>813</b>	<b>858</b>
<b>% sourced from own foreign mines</b>					<b>5%</b>	<b>6%</b>	<b>8%</b>	<b>9%</b>	<b>11%</b>	<b>16%</b>

Source: Companies, Standard Chartered Research

## Vale has a \$21bn iron ore capex programme...

*Brazil's tightening mining regulations causing delays to Vale's \$11.3bn Serra Sul project; unlikely to achieve its 90mtpa production target before 2017*

Vale was the least affected by the downturn given its strong balance sheet, but it was forced to shut down some 40% of its production after the 2008 crisis. All of this idled capacity is now back onstream and the group is running close to its 300m tonnes in production capacity. The group has the biggest capex programme of any iron ore producer, with \$21bn planned over the next 5 years. Some \$2.5bn is scheduled this year and we estimate that the most cost-effective expansion is 'Carajas Additional 10mt', which it has developed in the northern range of Carajas at a cost of just \$29/tonne or \$90m. That project is presently ramping up to full capacity. 'Carajas Additional 10mt' has environmental licences pending and the company expects this to cost \$24bn. This includes a new beneficiation plant and maritime terminal. In the meantime, the group plans to spend \$480m on the project this year with a scheduled start-up in the first half of 2012. We anticipate this expansion could add about 10m tonnes of volume in 2012 at best and reach full capacity in 2013

## ...but delays with its \$11.3bn Serra Sul project look inevitable

The largest investment is the southern orebody of its large Carajas mine, Serra Sul 'S11D', which has the potential to produce 90m tonnes at a capex of \$11.3bn. In early 2008, Vale said Serra Sul would be the largest greenfield iron ore project ever developed, with first production scheduled for the first half of 2013. Recently, the company announced that the project is still subject to obtaining environmental licences and board approval and that it should start up in the second half of 2013. Clearly, it will be increasingly difficult for Serra Sul to hit a 2H13 start-up target given the scale of the project. Some \$7.8bn of the \$11.3bn capex is related to the expansion of the rail and port facility to increase Northern System's shipment capacity to 230mt by 2015. As part of this expansion, Vale will extend the Carajas railroad by 100km to connect to the south range of Carajas. There will also be a duplication of the 605km of existing tracks and



the building of another (fourth) pier at the Ponta da Madeira terminal. This year, Vale anticipates a spend of \$1.13 billion on Serra Sul. Eight months into the year, however, it still has not received the environmental permits to start work. We now assume Serra Sul will begin production in 2015, some two years behind schedule. We also assume it will not hit full capacity of 90 million tonnes until 2017.

### What if BHP's RGP5 is delayed by 12 months

Like Vale, BHP was not affected by the crisis because it was cashed up and its timely withdrawal from the Rio Tinto bid meant it could concentrate on its existing RGP4 and RGP5 expansions. The group is slowly ramping up its RGP4 expansion after it reached completion at the end of 2009. The company expects full capacity of 26m tonnes by the end of 2011. This would take the group's production to 155m tonnes pa. In addition, the \$4.8bn RGP5 expansion to 205m tonnes is more than 50% complete. Officially, the company says that RGP5 will start mining in the second half of 2011. We would not be surprised if that date slips by 6–12 months as the new rail line may not be ready in time for the mine.

In total, BHP anticipates 8m tonnes of new production in 2010. As RGP4 continues to ramp up, it should add 4m tonnes in 2011. Assuming RGP5 does slip into 2012, then the group is likely to add 9m tonnes in 2012. Importantly, although RGP6 has received pre-commitment from the board for its \$1.9bn capex to add 35m tonnes of capacity, we think the project may face delays. BHP is now clearly focused on potash with its hostile bid for Potash Corp on August 17, so RGP6 is highly unlikely in the near term, in our view.

### Rio Tinto's Alcan deal has probably added \$30/t to iron prices

We believe that Rio Tinto's ill-timed \$40bn acquisition of Alcan in early 2008 has added as much as \$30/tonne to near-term iron ore prices. This is because it had reduced its much-touted expansion from 220m tonnes to 450m tonnes by 2015 after the 2008 crisis. In hindsight we believe Rio bought Alcan at probably the worst time imaginable. At the time, the justification for the deal seemed compelling: low-cost aluminium production with large, low-cost hydro-powered assets. In hindsight, it could have used the \$40bn funds to build a replica of its world-class Australian Pilbara operation instead. In 2009, Rio's aluminium business achieved 5% EBITDA margin while iron ore returned 57%.

After the crash of late 2008, Rio maintained a holding pattern for most of last year and has only just given the greenlight to restart the Pilbara expansion from 200m tonnes to 300m tonnes by 2015/16. We do not expect the first 50m tonnes of supply until 2016 at the earliest and believe the second tranche will probably not come online until 2017. Now that Chalco has agreed to take a 45% stake in the Simandou startup, we believe the timing for it to come online is also 2015. Again, the scale of such a greenfield project in a difficult part of the world puts the project at risk of slippage, especially if it cannot rail through Liberia or Sierra Leone (the cheaper and lower-capex option than to build 700km in Guinea).

### Anglo American's Minas Rio – most expensive development ever

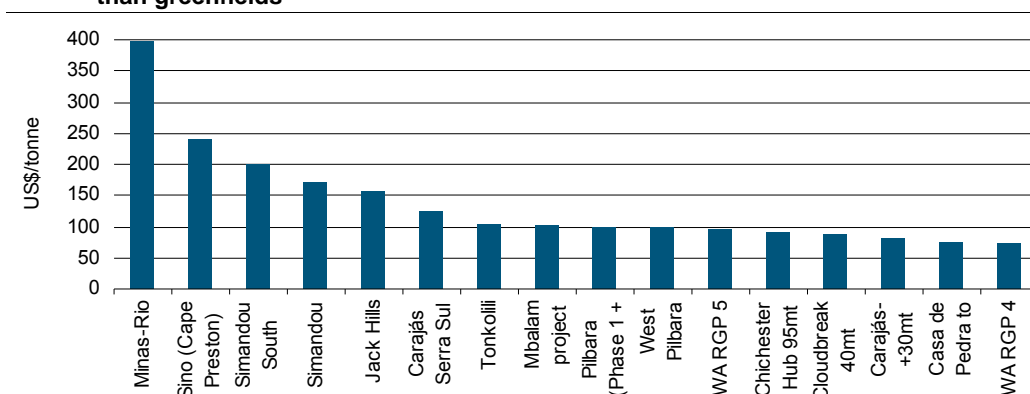
Minas Rio is undoubtedly the most expensive iron ore investment in the industry's history. After paying Ike Batista \$5.0bn in cash in 2008 for the deposit, land and environmental permit issues delayed the project. The challenge for Minas Rio we believe is the 500km slurry pipeline from the mine to the port and getting agreements from all the landowners along the way to build a pipeline on their properties. In the best case, we think Minas Rio could start production in mid-2013, three years later than its previous target set in 2008. Capex costs have escalated twice over the past three years and now the project, which was supposed to cost \$3.4bn, the total we believe is closer to \$5.3bn. This takes the investment for the 26m tonne operation to \$10.3bn including the acquisition price. This equates to a very expensive \$408/ tonne of capacity.

*Rio's acquisition of Alcan wiped out 250mt of new capacity by 2015; 150mt likely by 2018*

*At \$408/t capital intensity, Minas Rio is one of the most expensive developments ever. The project now needs a long-term iron ore price of \$125/t to generate 15% IRR, by our estimate*



**Fig 19: Capital intensities of major iron ore projects – Brownfields typically much cheaper than greenfields**



Source: Companies, Standard Chartered Research

## Citic Pacific's Sino Iron project world class, in our view

*Despite being marred by capex blowouts and delays, CITIC Pacific continued to develop the Sino Iron project, which will be the largest greenfield iron ore project to come onstream in the next 2 years*

Citic Pacific did not let the financial crisis impede construction of its 25m tonne Sino Iron magnetite iron ore project in the Pilbara. The development is the single largest foreign investment by any Chinese corporation in either mining or oil. The project is vast and includes the development of its own 450MW power plant, a 51 gigalitre desalination plant and a new port facility. The project is 80% owned by Citic Pacific and 20% by China Metallurgical Group Corporation (MCC). On 12 May, Citic Pacific announced it will pay an additional \$835m to Australia's iron-ore construction underwriter, MCC Mining, due to higher building costs. On this basis, we think the overall cost of building Sino Iron is likely to increase from its headline \$4bn to around \$6bn. Perhaps Citic is thinking longer term because, from its perspective, it will eventually have a large, world-class iron ore mine with the potential to expand to 50m tonnes or even 70m tonnes. The costs may be a lot higher and the projects may face delays, but at least it will control these projects. For now, we will watch with interest how this project rolls out its 25m tonnes of capacity. We believe it is one of the few that will reap the benefits of higher prices in 2011 and 2012.

## Most small Australian startups significantly delayed

Mt Gibson Iron is a good example of how the crisis in 2008 affected supply. Like so many others, it was caught short on funding for its expansion of Koolan Island hematite and the construction of Extension Hill. The group was to have increased production from 3.0m tonnes in 2008 to 9m tonnes by 2010. In the 2008 downturn, however, three of its key customers – Sinom, Pioneer and Rizhau – turned away shipments of Mt Gibson ore between September and November of that year. The group was forced to undertake emergency fund-raising totalling \$162m, causing a 2-year delay in its expansion programme. In 2011, the start up of its Koolan expansion from 3m tonnes to 4m tonnes will not begin until December, while the new Extension Hill mine is due for commissioning in June. Due to the crisis, Mt Gibson is only bringing on about 1m tonnes of new capacity in 2011 when it previously planned 4m tonnes.

## Fortescue – going to 95m tonnes by 2013/14

Fortescue is one of the great success stories in the iron ore industry. We like the management team as they pulled off what many Australian fund managers at the time thought they could never do – beat Rio Tinto and BHP at their own game by building a world-class operation with their own rail right on their larger neighbours' doorsteps. The group is in the middle of a A\$630m expansion from 40m tonnes to 55m tonnes. The group anticipates first production from the expansion in March 2011 with full capacity in the June quarter. This is a relatively cheap expansion at just \$42/tonne and would, assuming the current spot price of around \$140/ tonne, achieve payback in less than one year. The larger and much more expensive development is the proposed \$2.5bn



development of the nearby Solomon hub. A decision on Solomon is due by the end of the year with a development timeline of 2–3 years and earliest production in early 2013.

### **Kumba a success story amid the turmoil**

Kumba's (67% owned by Anglo American) \$1bn Kolomela (Sishen South) project was probably the only iron ore project on which development was pushed ahead after the economic crisis of 2008. Kolomela is now over 50% complete and is on track for first production in the second quarter of 2012 with a full capacity of 9m tonnes expected in late 2013. Management could probably stick to its guns during the crisis because Kumba was not stretched on the balance sheet and its existing Sishen mine is extremely low cost and is able to weather these types of storms. Nevertheless, even though the project is on track, it is still not likely to impact the market in a meaningful way until 2013 with no new supply for the next two years. The start-up of the Kolombela mine will also coincide with Kumba's closure of its small 2.5m tonne Thabazimbi mine. The net result is that Kumba should go from 41.9m tonnes in 2009 to 47m tonnes in 2013. Longer term, Kumba has North Cape (13m tonnes) and Limpopo (6m tonnes), but these are unlikely to impact new supply until 2019 at the earliest, in our view.

### **Gindalbie also persevered with help from Ansteel**

Gindalbie is another one of the few examples of companies that did not suffer a significant impact from the 2008 crash. This is largely thanks to the commitment from its largest shareholder Ansteel (parent to Angang). In November 2008, when other producers were freezing their projects, Ansteel subscribed for shares at 85 cents. Gindalbie raised a further A\$200m on 13 May of which Ansteel subscribed for A\$63.2m to maintain its holding at 36.1%. Ansteel also owns a 50% stake in the Karara iron mine, otherwise known as the KML Joint Venture, for which it helped arrange a \$1.2bn loan with the Chinese Development Bank.

Gindalbie and Ansteel will borrow the money from the CDB on a 50/50 basis. The original bankable feasibility study in September 2007 estimated the project would cost \$1.65bn. Since then, the cost has increased by another 20% to \$1.975bn. The upfront capex will provide the company with rail capacity of 36m tonnes and power transmission to support capacity of 40m tonnes. Phase 1 of the project is to produce 2m tonnes of hematite and 8m tonnes of a 68% grading magnetite. The Chinese prefer an end-product of high-grade magnetite, even though the upfront capital costs are significantly higher than for the higher grade 'dig it up and ship it' hematite. Management is hopeful the rail link will be completed in mid-2011. Production will start with the nearer surface hematite with magnetite scheduled to ship in early 2012. Clearly, the key is the 85km rail link and the timing of its first shipment. Either way, we believe Gindalbie will have no real impact on the 2011 iron ore market, but should be operating at full capacity by mid-2012.

### **MMX a rising star in iron ore**

*MMX is one of very few to deliver near term growth; ArcelorMittal to follow Wuhan in buying a stake in MMX*

MMX is one of very few companies that we expect to bring significant near-term iron ore growth. Its attractive portfolio of assets has already led to Wuhan Iron and Steel investing in a 21.5% stake, with ArcelorMittal announcing an interest in buying into MMX to boost its iron ore self sufficiency. MMX currently has an annual capacity of some 11m tonnes of iron ore from its two producing mines: the Serra Azul mine (located in Minas Gerais Iron Ore Quadrangle) and at Corumba in Brazil. The Serra Azul mine site (8.7m tonnes pa capacity) is connected to the Sudeste port 390km away via the MRS rail system. The company has secured long-term contracts to transport 15m tonnes with MRS. MMX is negotiating with MRS to secure an additional 17m tonnes of rail capacity to support its expansion programme at Serra Azul and the new greenfield development at Bom Sucesso, which lies south of the former in the Iron Quadrangle. The Bom Sucesso deposit is lower grade at 30% Fe but located 40km from the MRS railroad and 240km from the Sudeste port. The company expects to commence production at Bom Sucesso by 2013. MMX aims to produce 32m tonnes of iron ore annually from its Sudeste system (Serra Azul & Bom Sucesso deposits) by 2015.





MMX also owns mining rights with an option to acquire two additional mining rights in the Atacama region of Chile. The mining rights are located 800km north of Santiago, but conveniently within 50km of the Chilean coast. The prospects are presently subject to a two-year drilling campaign scheduled to be completed in 2012. According to MMX, these prospects have the potential to produce 10m tonnes of iron ore.

Among the major iron ore projects in the Iron Quadrangle, MMX has the most simplistic mine and logistics design, in our view. Unlike projects for which land acquisitions, permits and transportation logistics (pipelines) present a conundrum for other companies, MMX has secured mining rights and its plans to transport its incremental production via the tried-and-tested route of rail transportation. We believe this gives MMX one of the lowest development risk profiles among iron ore developers.

### Indian export growth of iron ore to China may be slowing

*India's iron ore exports to China could decelerate as the country looks to increase ore availability for the domestic steel mills*

India is the world's third-largest exporter of iron ore. The country exported nearly 100m tonnes of iron ore in 2009 and has the potential to increase exports by 50% in the next three years. India's steel producers have lobbied hard to curb iron ore exports to increase the country's ore availability and to reduce domestic iron ore prices. While we feel that the iron ore export taxes could be increased from 5% for fines and 15% for lumps, we think a complete ban on exports, as mooted by the media, is highly unlikely. An increase in export taxes would force some of the smaller, higher-cost miners to sell their ores domestically as it would be less profitable for them to export it given transportation costs.

Moreover, the Indian government's steel expansion plans are being hindered by delayed acquisitions by companies such as ArcelorMittal and Posco, whose projects are already delayed by up to five years. We think the government's target to achieve 120m tonnes pa, up from 60m tonnes in 2009 is ambitious given that many of the projects have not yet completed their land acquisitions. Also, there is an expectation that many of these projects will integrate with captive iron ore mines and will not depend on "exported" iron ore.

### Sierra Leone has enormous potential

One of the largest undeveloped orebodies in the world today is Tonkolili in Sierra Leone, which is owned by African Minerals Plc (AML). In April, it announced a 10.5bn tonne JORC-compliant mineral resource on the 20km strike. This orebody has the potential for an 800m tonne, high-grade hematite cap, which should provide early cashflow for the project. The rest is magnetite, which is upgradeable to a 70.3% concentrate. On paper, this orebody has similar characteristics to Carajas in Brazil or Pilbara in Australia, and we find it surprising that Vale chose Guinea before this project. What also surprises us is that neither BHP or Rio Tinto have targeted it, as we believe this is a world-class asset that will one day host a 100m tonne complex.

On 1 April, African Minerals signed a definitive agreement with China Railway Materials (CRM) to acquire 12.5% of African Minerals enlarged share capital at GBP5.00 per share (current share price GBP3.20) to raise some \$250m. African Minerals also announced the sale its 25% stake in its Tonkolili project in July to China's Shandong Steel under an MOU to supply 10m tonnes pa at a 15% discount to the benchmark price. These agreements are pending approval from the Chinese government, due in the third quarter. AML's management expects the first production of up to 8m tonnes of hematite ore by 2011. Realistically, that will probably be late 2011, in our view. It will initially truck its ore to the existing port while work on the rail upgrade continues. Road works began in April ahead of the rainy season in August.

In the medium term, AML's target is 25m tonnes. We believe that it could reach a longer-term level of 50–75m tonnes. We have a high degree of confidence that this project will come onstream within a reasonable time, given the strength of management team, led by Alan Wattling, who was formerly a major driving force behind the success of Fortescue and the start-up of its 40mtpa Cloudbreak mine in the Pilbara. The challenge we believe is whether AML's Australian



team can deliver the same kind of project in the different operating environment in Sierra Leone. The presence of CRM and Shandong Steel will certainly make this challenge more achievable and their rail building expertise would be a major advantage for the project.

African Minerals has a market cap of just \$2bn. It controls the rail in the country, which could prove valuable for the Rio Tinto/Chalco Simandou project in Guinea. This market cap would seem small change for the Big 3 to secure the largest undeveloped iron ore asset. Vale and Rio Tinto both have Simandou. Perhaps it's BHP's turn to step up to the plate?

### **In summary, iron ore prices are likely to spike**

We believe it is all about supply, and for the next two years, very little coming onstream. Strong demand from the steel producers is not necessary to drive prices up. In the medium term, after 2014, we believe the industry could bring too much capacity onstream. Yan Chen our mining analyst recommends an Outperform on China Vanadium (893 HK, HKD2.69, O/P, FV HKD4.20, Yan Chen).

**Fig 20: New iron ore projects (production in million tonnes)**

Mines	Company	Country	2010E	2011E	2012E	2013E	2014E	2015E	2016E
West Pilbara (API)	Aquila Resources / M&C / POSCO	Australia					5	25	30
Abydos	Atlas/Aurox	Australia		1	3	3	3	3	3
Pardoo	Atlas/Aurox	Australia	1	2	3	3	3	3	3
Wodgina	Atlas/Aurox	Australia	1	1	2	3	4	4	4
Nullagine	BC Iron/FMG	Australia	0	1	3	5	5	5	5
WA RGP 4	BHP Billiton	Australia	10	16	20	26	26	26	26
WA RGP 5	BHP Billiton	Australia		0	5	25	40	50	50
Sheep Hill/Wilgerup	Centrex/WISCO/Batou	Australia						3	5
Cape Lambert	China Met Corp	Australia	0	0	0			2	4
Sino Iron	Citic Pacific / CMG	Australia	0	3	10	18	25	25	25
Cloudbreak 40mt	FMG	Australia	0	5	10	15	20	40	45
Chichester Hub 55mt	FMG	Australia		5	12	15	15	15	15
Chichester Hub 95mt	FMG	Australia				5	20	30	40
Karara Magnetite	Gindalbie Metals / Anshan Iron	Australia	0	1	6	9	11	11	16
Southdown	Grange Resources	Australia	0	0	0	0	1	7	7
Weld Range	Midwest / Sinosteel	Australia		0	0	0	2	5	15
Extension hills/Koolan Island	Mt Gibson Iron	Australia	1	2	4	4	4	4	4
Jack Hills	Murchison Metals	Australia	2	2	2	2	5	10	15
Pilbara (Phase 1 + 50mt)	Rio Tinto	Australia					5	25	35
Pilbara (Phase 2 + 50mt)	Rio Tinto	Australia							20
Carajás Serra Sul	Vale	Brazil			0	0	0	10	50
Conceicao Itabiritos	Vale	Brazil					6	12	12
Apolo	Vale	Brazil						10	24
Vargem Grande Itabiritos	Vale	Brazil					5	10	10
Minas-Rio	Anglo American	Brazil	0	0	0	5	18	26	26
Serra Azul expansion	MMX	Brazil	2	4	5	6	10	10	10
Bom Sucesso	MMX	Brazil					2	10	17
Carajás+30mt	Vale	Brazil		0	8	25	30	30	30
Carajas idled capacity	Vale	Brazil	20	20	20	20	20	20	20
Casa de Pedra to 48mt	CSN	Brazil	0	7	7	20	21	21	21
NAMISA to 39mt	CSN (60%)	Brazil	15	18	18	30	33	39	39
Mary River	Baffinland Iron Ore Mines	Canada					0	3	6
Schefferville Project	Labrador Iron	Canada	1	2	2	3	3	4	4
Chile	MMX	Chile						1	5
Mbalam project	Sundance Resources	Cameroon						5	10
Isua	London Mining	Greenland							5
Simandou	Rio Tinto / Chinalco	Guinea							10
Simandou South (Zogota)	BSG / Vale	Guinea							20
Sesa Goa	Sesa Goa	India			3	15	25	25	25
ENRC	ENRC	Kazakhstan	0	0	0	2	4	4	4
Nimba	Arcelor Mittal	Liberia		0	0	0	3	13	13
K&S	Petropavlovsk	Russia				1.0	2.5	3.2	3.2
Marcora	Shougang Hierro	Peru			2	5	8	10	10
Wadi Sarawin	London Mining	Saudi Arabia				0	3	8	10
Faleme	Arcelor Mittal	Senegal			0	4	10	20	20
Tonkolili	African Minerals / Shandong	Sierra Leone			3	8	13	23	25
Marampa Project	Cape Lambert / African Minerals	Sierra Leone					5	10	10
Marampa	London Mining	Sierra Leone					2	4	4
Khumani/Beeshoek	Assmang	South Africa	8	9	9	10	10	10	10
Sishen C-gr (Northern Cape)	Kumba Iron ore	South Africa				0	0	0	2
Sishen South (Kolomela)	Kumba Iron ore	South Africa		0	2	9	9	9	9
Limpopo	Kumba Iron ore	South Africa						0	2
Veremo Pig Iron	Veremo Holdings	South Africa				0	1	2	2
Yeristovskoe	Ferrexpo	Ukraine		0	0	0	4	10	20
<b>Total new supply</b>			<b>55</b>	<b>87</b>	<b>142</b>	<b>260</b>	<b>380</b>	<b>592</b>	<b>776</b>
<b>Incremental Production</b>			<b>55</b>	<b>33</b>	<b>55</b>	<b>118</b>	<b>120</b>	<b>212</b>	<b>184</b>

Source: Company guidance, Standard Chartered Research



## Copper – Red gold

- Current copper mine supply is the tightest on record.
- 3.5m tonnes of new supply delayed due to the 2008 financial crisis.
- Ageing mines, declining ore grades, deeper mines, increasing costs and labour unrest.
- Largest copper mines have average age of 52 years – likely why they are missing targets .
- Market expected to be in deficit until 2013 assuming conservative demand assumptions.
- Oversupply expected in 2015 but market not looking that far ahead.
- Consumers have destocked at a time when we think copper could spike to \$12,000/tonne.

*Our resident copper expert, Dan Smith, forecasts copper price to trade up to \$8,060/tonne near term; thereafter we forecast copper price to spike to \$12,000/t in the next 2 years*

New-copper from the industry suffered a huge shortage before the 2008 financial crisis. Today, it looks even worse – we project only 0.9% supply growth in 2011. In fact, we think copper has the best fundamentals among the metal or bulk commodities. The tightness in the market is a hangover from the 1997 Asian financial crisis. After copper prices collapsed to only \$0.60/pound in 1998, many copper producers were forced to high grade their mines to retain positive cashflow. Twelve years later, the industry is paying for this high grading and ore quality through the mills continues to decline. At the same time, the Democratic Republic of Congo has remained a major disappointment and delivered a fraction of its true potential, which we estimate at nearly 2m tonnes of capacity. Coupled with the 2008 financial crisis and we see that many of the projects that were to come onstream from 2010 are now 2014 stories at the earliest. With consumers now destocked in the US, Europe and China, the near-term price movements could prove to be volatile on the upside. Time will tell if the 'double dip' recession eventuates and foils our bullish outlook, but thus far, copper has held up remarkably well amid the bearish markets in May and June. Our copper analyst, Dan Smith, forecasts the copper price to trade up to \$8,060/tonne near term. Thereafter we believe copper could rise to about \$12,000/ tonne in the next 2 years.

### Deficits likely until 2013 – stockpile drawdowns to accelerate

*We forecast significant copper market deficits in the next 3 years, even assuming conservative demand growth of 1.9% pa, which compares with 4.3% pa in the past 5 years and 3.0% pa historically since 1929*

We estimate the copper market will remain in significant deficit, at least until 2013. Our model assumes what we believe is conservative average demand growth of 1.9% pa for the next four years. On that basis, this imbalance will exhaust some 500,000 tonnes of the stockpile. The combined inventory of the LME and Shanghai is presently 452,000 tonnes. We think consumer inventories have run down as they have destocked due to the poor macro outlook.

We would not be surprised if the next 12 months brought demand growth of 5–6% as consumers may have to turn to the market and restock. If developed economies show signs of recovery, there is also a high possibility that longer-term demand comes in stronger than we have anticipated, augmenting already strong emerging economies. Demand growth in this scenario could easily reach 4%. This compares with global demand growth of 4.3% pa in the past 5 years, 3.3% pa in the past 10 years and 3.0% pa historically since 1929. If we assume demand growth of 3.0% pa, incremental demand would total 3.5m tonnes by 2015, while the global supply would be only 3.3m tonnes on the assumption that all projects are commissioned as scheduled. In short, our model assumes that there will be a surplus in 2014/15, but if demand surprises at 3%, copper prices could stay stronger for longer.

**Fig 21: Copper supply/demand – in deficit assuming meagre demand growth**

('000 tonnes)	Standard Chartered forecasts ('000 tonnes)						
	2009	2010E	2011E	2012E	2013E	2014E	2015E
<b>Supply</b>							
Chile	5,642	5,674	5,777	5,885	5,970	6,345	6,890
Zambia	847	847	887	947	1,007	1,032	1,041
DR Congo	367	441	476	501	611	706	756
Indonesia	925	905	855	845	835	825	815
Australia	872	867	862	857	852	847	842
US	1,204	1,194	1,184	1,174	1,164	1,154	1,144
Peru	1,275	1,225	1,195	1,245	1,390	1,582	1,987
Mongolia	10	10	10	10	40	110	210
ROW	7,235	7,190	7,275	7,439	7,525	7,726	8,030
<b>Global supply</b>	<b>18,377</b>	<b>18,353</b>	<b>18,521</b>	<b>18,903</b>	<b>19,394</b>	<b>20,327</b>	<b>21,715</b>
Yoy (%)		-0.1%	0.9%	2.1%	2.6%	4.8%	6.8%
Yoy (kt)		-24	168	382	491	933	1,389
<b>Demand</b>							
North America	1,863	1,863	1,868	1,915	1,962	2,010	2,060
South & Central America	505	520	535	551	568	594	629
Europe	3,505	3,540	3,575	3,611	3,647	3,711	3,777
Asia	10,356	10,631	10,914	11,269	11,703	12,200	12,817
Australasia	112	114	112	107	103	102	101
Africa	322	324	327	333	343	361	380
ROW	1,527	1,374	1,305	1,279	1,267	1,279	1,292
<b>Global demand</b>	<b>18,189</b>	<b>18,365</b>	<b>18,636</b>	<b>19,066</b>	<b>19,593</b>	<b>20,257</b>	<b>21,057</b>
YoY (%)		1.0%	1.5%	2.3%	2.8%	3.4%	3.9%
YoY (kt)		176	271	430	527	664	799
<b>Surplus/ (Deficit)</b>	<b>188</b>	<b>(12)</b>	<b>(115)</b>	<b>(164)</b>	<b>(199)</b>	<b>70</b>	<b>659</b>

Source: ICSG, Standard Chartered Research estimates

## Supply growth in 2010 estimated to be flat

*Copper production will be flat YoY in 2010 at best because of production misses at existing mines and project delays*

Due to a mixture of production misses from existing mines and limited new capacity, we anticipate flat copper supply growth this year. We think this is why the copper price has been resilient in the face of the Euro debt crisis and the equity market sell-off in May and June. The risk now, we believe, is that demand could actually surprise in Q410, especially given that consumers are running on a hand-to-mouth basis. So far this year, demand growth from China and other developing economies has offset the destocking cycle in the US and Europe. As such, we believe the copper industry is not ready for a surge in demand if a restocking cycle returns.

The financial crisis of 2008 is mainly to blame, in our view. We expect new copper supply to grow by only 185,000 tonnes in 2010. This compares with the industry's plans prior to the 2008 crisis to build some 900,000 tonnes in 2010. One of the only producers that continued construction after the crash was Antofagasta, which is now bringing on the Los Pelambres expansion and the Esperanza project at what we view is the right time. Antofagasta was often criticised in the past for carrying too much net cash (around \$3bn), but this has allowed it to keep building when others – Xstrata, Anglo American, Kazakhmys, Freeport and Rio Tinto – were all forced to put their investment plans on hold. We commend Antofagasta for sticking with its plans.

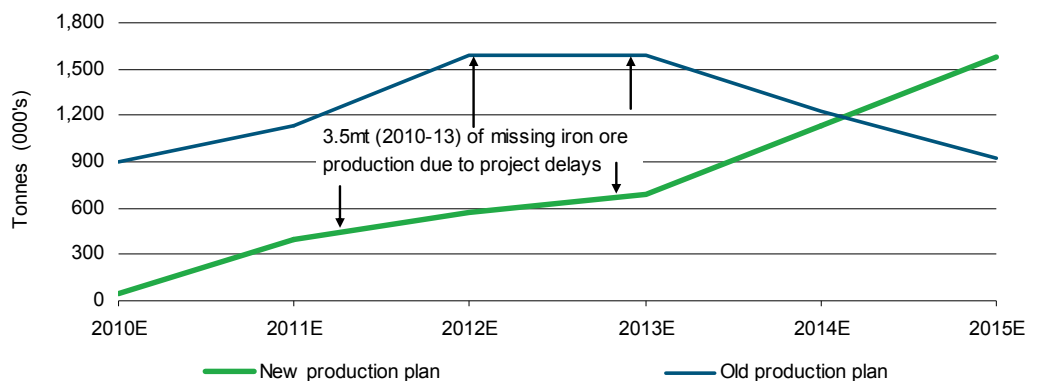


At the same time, existing mines have struggled. Already this year, Freeport's production in the first half was down 12% YoY, BHP down 5% and Xstrata down some 6%, primarily due to lower grades and ageing mines. We estimate that the new incremental capacity would be just enough to compensate production misses from existing mines. Looking forward, mine sequencing and lower grades have forced Freeport to downgrade Grasberg's 2011 production target by 50,000 tonnes and BHP's Escondida by 50,000 tonnes. The high grading of the late 1990s appears to be coming home to roost, in our view.

## Sharp industry reaction to the 2008 financial crisis

The industry had few options following the 2008 crisis after banks pulled lending and equity markets froze up. Figure 22 illustrates the impact of the 2008 crisis on near-term supply. Three years ago, before the Bear Stearns meltdown, supply was expected to grow by some 900,000 tonnes in 2010, equating to 5% growth. Today, new supply growth is likely to be 181,000 tonnes at most, by our estimate. This is a shortfall of 719,000 tonnes. However, at the same time as new supply comes onstream, older mines usually have lower production due to falling grades. We assume a 2010 depletion rate of 205,000 tonnes. That would imply negative supply growth of 24,000 tonnes in 2010. It is little wonder to us then that copper inventories on the LME continue to decline. The situation does not look much better for 2011. Three years ago, the industry had hoped to deliver up to 1.1m tonnes of new mine supply. Today, a realistic number, in our view, is only around 400,000 tonnes before considering the depletion at the older mines of 235,000 tonnes. Again, that implies 2011 growth of only 168,000 tonnes. This is a key factor in our increasingly bullish view on copper.

**Fig 22: Copper supply curve: Old vs current production plans**

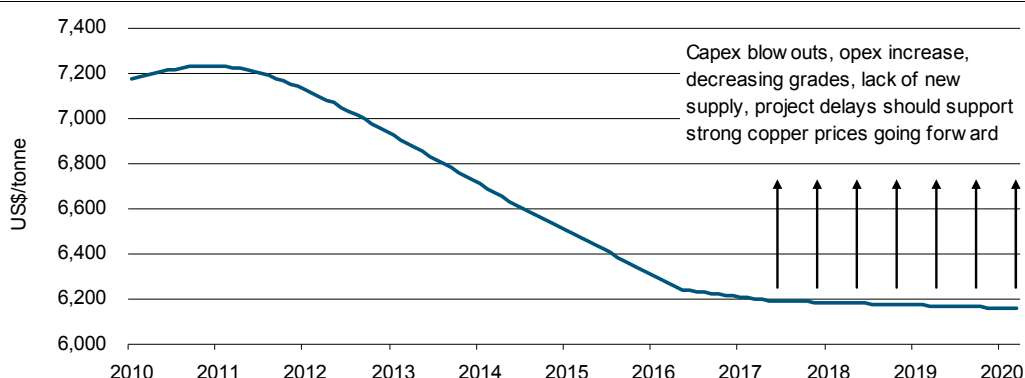


Source: Standard Chartered Research estimates

*Can the copper forward price curve move into contango? This would have a huge impact on the equity valuation*

In sum, from 2010 to 2014, the 2008 financial crisis has delayed some 3.5m tonnes of capacity. This is a big number and the one thing we do not understand is why the forward curve is still in backwardation. Of all the commodities we have analysed, copper is the one that should be firmly in contango. This could be the most important trade we witness in the mining industry in the next 12 months – a move into contango on copper.

The bears would argue about supply in 2015, when some of the large Chilean and Peruvian projects/expansions come onstream. The market could return to a surplus, but we note that many of these projects could face delays and there is no certainty of how strong demand would be from the emerging regions. In the meantime, however, we believe producers are set to reap huge profits based on our call of \$12,000/tonne of copper).

**Fig 23: Copper forward curve – from backwardation to contango?**

Source: Bloomberg, Standard Chartered Research

### Why is the copper price well above the average marginal cost?

The common error that investors make is that they tend to believe that it is a matter of time before the copper price migrates back to the marginal highest cost producer in the industry, which is around \$2.0/ pound. We estimate new copper projects, on average, require a \$2.83/pound copper price to incentivise their development (assuming 15% IRR), which is only 12% below the present spot price. If the miners have a 20% IRR as the benchmark for developing new projects, we estimate an incentive price of \$3.25/pound, which is in the ballpark of the present spot price. Given an environment of increasing production costs and capex blowouts, we estimate copper price of \$3.00/pound as the floor for the longer term.

**Fig 24: Incentive copper price to generate 15% IRR (based on 80 new projects)**

Particulars		Amount
Total capex	US\$m	123,318
Annual capacity	kt	9,215
Capital intensity	US\$/t	13,382
Average cash costs (mine life)	US\$/lb	1.0
<b>Implied copper price for 15% IRR</b>		<b>US\$2.83 per pound</b>

Source: Standard Chartered Research estimates

### Partly because its hard to find new copper deposits

Figure 25 details only one significant discovery in the past two decades that has been brought into production until now. The Ivanhoe/Rio Tinto Oyu Tolgoi deposit in Mongolia, which was discovered in 1998, should produce its first copper by 2013 at the earliest, 16 years after its discovery. Oyu Tolgoi is regarded as the largest undeveloped copper deposit in the world, hosting nearly 36m tonnes of copper metal in ore resources. Ivanhoe estimates the pre-production capex required to bring this mine into production at \$5.7bn or \$12,666/tonne of copper capacity, excluding the cost of building a coal-fired power plant to provide power to the mine site. This illustrates that new world-class copper projects are hard to come by and are located in remote areas requiring significant capex and time to bring them into production. Also, the existing major copper mines are ageing, with an average age of 52 years with 30 years of mine life remaining. Most of these mines are past their peak production.

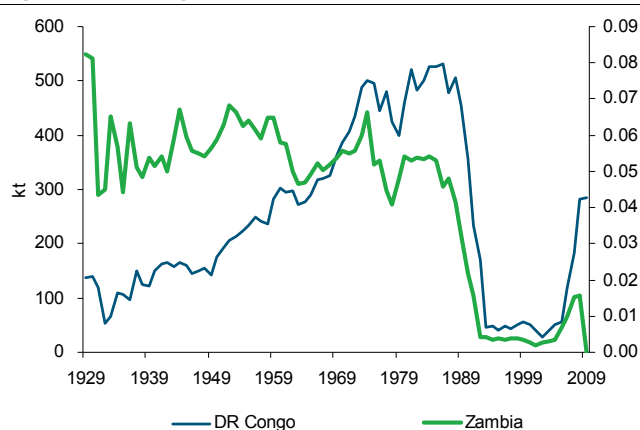
**Fig 25: Key copper mines/projects discovered**

Mine	Discovery	Start-up	Company	Reserves (mt)	Grade	Contained Cu (kt)	Production (kt)	Mine life	Age
Escondida	1979	1991	BHP / Rio	4,135	0.79%	27,889	1,026	27	19
Chuquibambilla	1898	1910	Codelco	2,476	0.71%	14,943	755	20	100
Grasberg	1988	1997	Freeport	2,590	1.01%	22,152	635	35	13
Collahuasi	1979	1999	Xstrata / Anglo	2,214	0.83%	15,564	511	30	11
KGHM	1957	1968	KGHM Polska	1,262	2.06%	22,098	502	44	42
Oyu Tolgoi	1997	2014	Ivanhoe / Rio	1,393	0.93%	11,012	450	24	
Los Pelambres	1968	2000	Antofagasta	1,502	0.64%	8,171	407	20	10
Norilsk	1935	n.a.	Norilsk	320	2.60%	7,071	400	18	
El Teniente	1905	1967	Codelco	1,613	1.00%	13,724	381	36	43
Antamina	1991	2001	Xstrata / BHP	401	1.12%	3,802	322	12	9
Bingham Canyon	1899	1906	Rio Tinto	524	0.47%	2,093	303	7	104
Cerro Verde	1860	n.a.	Freeport	3,053	0.41%	10,640	300	35	120
Andina	1865	n.a.	Codelco	1,980	0.82%	13,834	220	63	120
Cuajone	1945	1978	Southern Copper	2,466	0.52%	10,884	196	56	32
Toquepala	1890	1960	Southern Copper	5,599	0.35%	16,725	152	110	50
La Caridad	1967	n.a.	Southern Copper	4,945	0.20%	8,275	119	70	
<b>Total / Average</b>						<b>201,816</b>	<b>6,680</b>	<b>30</b>	<b>52</b>

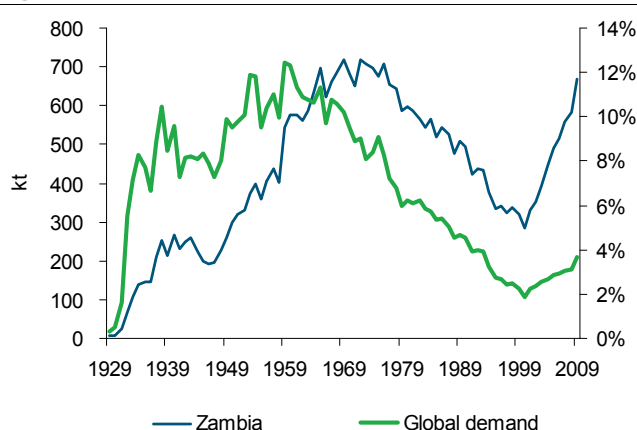
Source: Company data, Standard Chartered Research

## Will DR Congo achieve its potential of 2m tonnes of copper?

Copper production from DR Congo and Zambia has increased steadily in the past 3–5 years. While Zambia has been a relatively good example of how to build up production, DR Congo remains a difficult place to conduct business. The DR Congo reached its peak production in the 1980s, when it produced as much as 540,000 tonnes of copper pa, contributing 5.4% of global supply. Civil war and political instabilities led to a rapid production decline in the 1990s, when the country produced only 40,000 tonnes of copper pa or just 7.5% of its production capacity. The country has slowly built up production to around 300,000 tonnes, due in part to Freeport, Camec (now part of ENRC) and First Quantum, and partly to the vast artisanal backyard mining operations that support the small Chinese operations (some 15 in Katanga Province). On paper, the Katanga Province in DR Congo should produce at least 2m tonnes pa. First Quantum is embroiled in a long-drawn-out dispute with the government over ownership (which is depressing the share price at a time when it should be riding on the high copper price). However, this rich country is likely to continue to deliver well below its potential, which is good news for copper.

**Fig 26: DR Congo copper production**

Source: ICSG, Standard Chartered Research

**Fig 27: Zambia copper production**

Source: ICSG, Standard Chartered Research estimates





On the other hand, Zambia's copper production has rebounded from a steady decline in the 1970s owing to decreasing copper prices. The country is producing 670kt of copper pa, which could reach close to 1m tonnes once Vedanta's Konkola Deep achieves full capacity next year. That said, Zambia is producing only 3.7% of the global total, down from 10–12% it contributed during its glory years in the 1960s

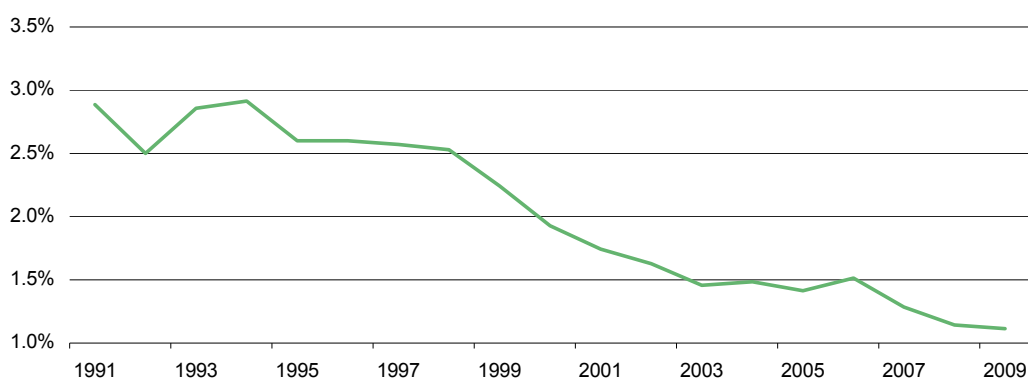
### Capex costs have roughly doubled in five years

\ We believe that buying an existing producer makes more commercial sense than building a copper mine today as the price differential between the two is almost negligible. The cost to build a greenfield copper mine today is around \$13,000/ tonne (\$13,382 to be exact) of annual capacity. This is for an average porphyry low-grade copper/gold project in countries such as Chile, Peru, Indonesia or the Philippines. This compares with a cost of around \$7,000/ tonne in 2005. To generate a 20% IRR, these projects require a long-term copper price of \$2.83/pound (\$6,239/tonne). This is in stark contrast to the long-term price range of \$0.80–1.20/pound that analysts were using in their models only a couple of years ago. A typical example of the cost escalation is the Tampakan project in the Philippines. Indophil Resources originally estimated the project capex at \$1bn with first copper production scheduled for 2011. As it now stands, however, Xstrata estimates project capex at \$5.5bn (inclusive of the power plant required at the mine site) with a production start-up timeline of 2016 at the earliest.

### Copper producers struggle to maintain steady production

Various factors have impacted copper supplies. These include declining ore grades, labour disputes, regional/political unrest, supply issues, such as mill breakdowns, and lack of availability of skilled labour and mining equipment. A few miners have also faced difficulties in accessing funds to fuel their growth projects. Escondida, the world's largest copper mine, is mining copper head grades of c.1% compared with c.3% during the first few years of operation. The company estimates ore reserves at 4.1bn tonnes at 0.78% grade, which implies that the mining grades are likely to fall going forward. At a 0.78% reserve grade, the mine will likely need to move 3.8 times more earth to produce one tonne of copper than it did when it was first commissioned in 1991. We believe that Escondida will eventually need to spend some \$2bn to expand its milling capacity merely to keep its existing production steady.

**Fig 28: Escondida ore grade since its first production**



Source: Company data

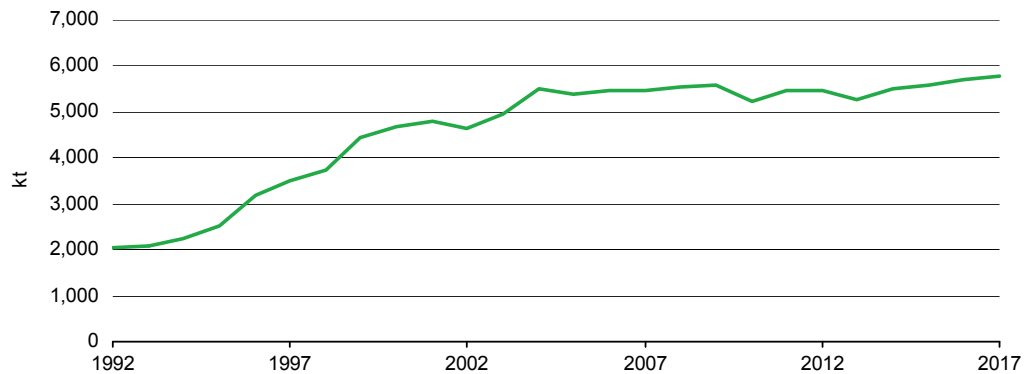
### Chilean copper production appears to have matured

While we estimate 31% of potential new capacity will come from Chile, water and power shortages could hinder development of these projects. Moreover, most of the existing mines are ageing as companies struggle to maintain production due to lower grades and deeper mines. Even assuming that all the Chilean projects come onstream as scheduled, the country's copper production may



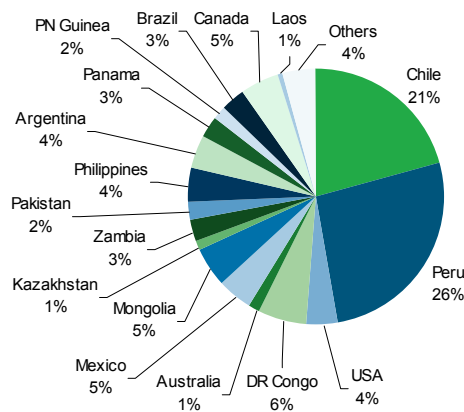
remain flat at best going forward, with depletion of ageing operational mines likely to decrease production by as much as 1.2m tonnes in the next 5–7 years as illustrated in Figure 29.

**Fig 29: Chilean copper production**



Source: ICSG, Standard Chartered Research

**Fig 30: New copper capacity by country**



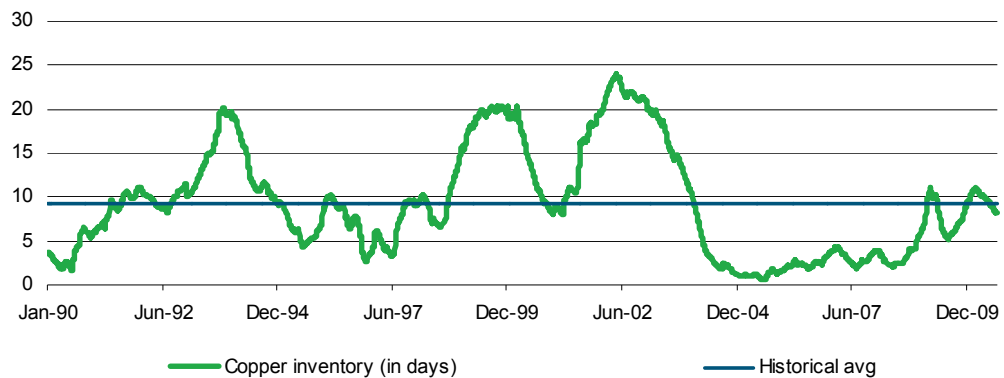
Source: Companies, Standard Chartered Research estimates

### Copper inventories at below historical average (in days of consumption)

Fig 31 illustrates that the global copper inventories are at only 8.2 days of consumption, below the historical average of 9.3 days. We believe that all it would take to deplete inventory a stoppage at a big mine (eg. labour disputes, earth quakes, mill breakdown). Given there has been very little inventory restocking with many downstream producers opting for just-in-time deliveries to operate on reduced working capital, there is very little copper in the system and we estimate one large production miss could significantly hike up copper prices. For 2010, we estimate that the industry has already missed some 150kt of copper due to the Olympic Dam conveyor accident, Chilean earthquakes and production misses at Freeport, BHP Billiton and Xstrata.



**Fig 31: LME Copper : Inventory in days**

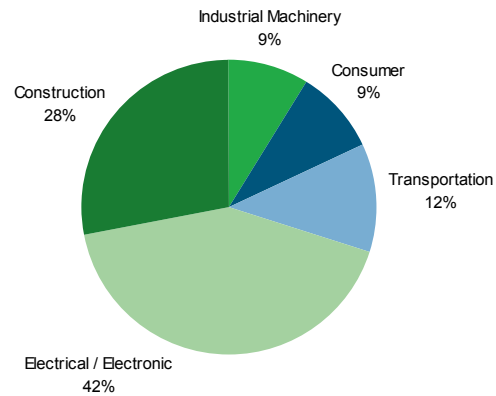


Source: Bloomberg

### Diversified usage to aid solid demand growth for copper

Unlike other metals, copper is used almost equally for industrial and consumer purposes. Among base metals, red metal had the best demand growth of 2.1% pa in the past decade. Due to its balanced demand from industrial and consumer sectors, we believe that copper has more stable demand fundamentals than other metals. Moreover, we feel that there will likely be a switch from aluminium to copper in electrical appliances in developing economies as the focus shifts from rapid, low-cost growth to efficiency and safety. Aluminium is a poorer conductor of electricity than copper, by 40% but it incurs only 25% of the cost. Many developing countries have preferred aluminium wire cables over copper due to their low cost. Aluminium wires are, however, prone to overheating and fires.

**Fig 32: Copper consumption – by end use**



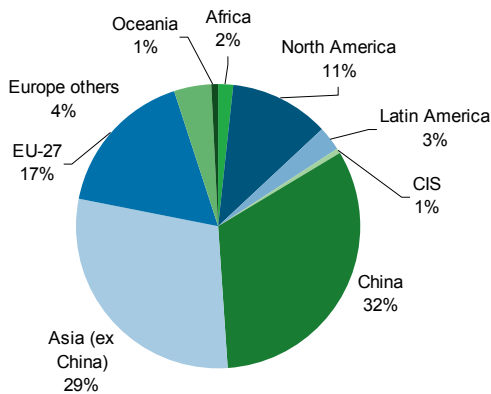
Source: LME, Standard Chartered Research estimates

### China now consumes 35% of the global copper supply

In 2010, we expect China to consume nearly 35% of the global copper supply, up from 32% in 2009 and c.25% before the credit crunch. We estimate China’s consumption will grow at a steady rate of 3–4% pa on the back of urbanisation and infrastructure spend. We conservatively assume 1–2% growth for European and US consumption

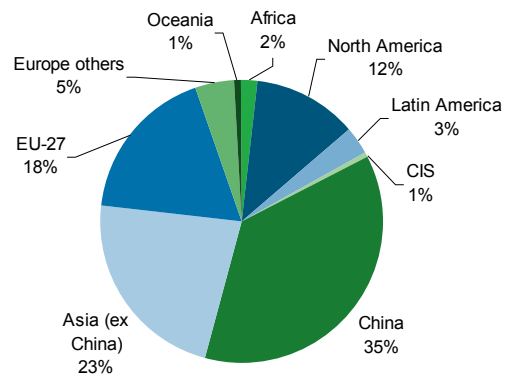


**Fig 33: 2009 Copper demand – by country**



Source: ICSG, Standard Chartered Research estimates

**Fig 34: 2010 Copper demand – by country**

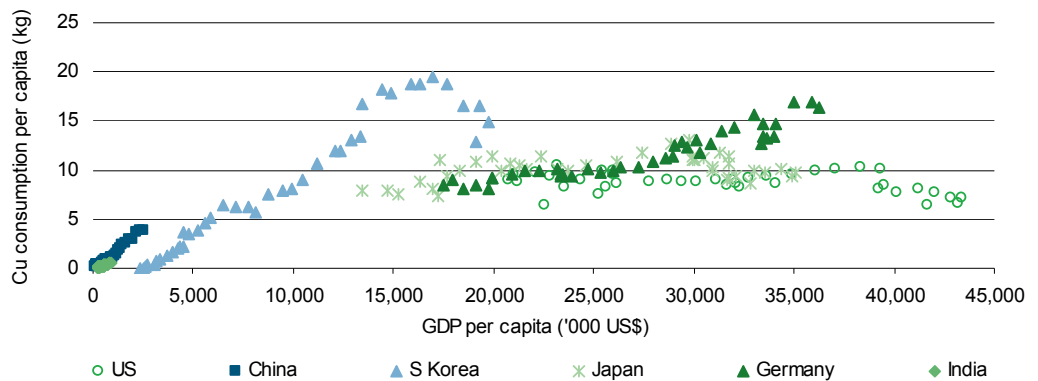


Source: Standard Chartered Research estimates

**... but still has a very low per capita consumption**

China consumed only 3.9kg of copper per capita in 2009, compared with 6.5kg for the US, 8.6kg for Japan and 14.6kg for Germany. India consumed only 0.6kg of copper per capita in 2009. If we assume that China and India could consume 5kg and 2.5kg of copper per capita, respectively, by end-2015, the world would require 3.6m tonnes of new copper capacity or three new Escondidas or eight new Oyu Tolgoi. Nowadays, sizeable copper deposits are hard to find and the world may never see another Escondida or even an Oyu Tolgoi. We estimate that the current copper projects could bring only 3.3m tonnes of new capacity by 2015, which would not be sufficient to feed demand from China and India if they were to increase their consumption to 5kg and 2.5kg of copper per capita in the next 5 years.

**Fig 35: GDP and copper consumption – per capita since 1969**



Source: USDA Economics, Standard Chartered Research estimates

**We would not short copper**

In summary, we would not short copper. We believe that position constitutes a very dangerous trade. We do not remember a period when the market was this tight. Standard Chartered's copper analyst, Dan Smith, believes near-term copper will trade to \$8,060/tonne in the near term. Thereafter, we anticipate it to rise to \$12,000/tonne over the next two years.



Fig 36: New copper projects

Mines	Company	Country	Cumulative Supply (m tonnes)						
			2010E	2011E	2012E	2013E	2014E	2015E	
Agua Rica	Yamana	Argentina							NP
El Pachon	Xstrata	Argentina							NP
Olympic Dam Exp	BHP Billiton	Australia							NP
Spinifex Ridge	Moly Mines	Australia							5
Lady Annie	CTC	Australia		25	30	30	30		30
Ernest Henry u/g	Xstrata	Australia		10	20	35	50		50
Ernest Henry open pit	Xstrata	Australia	-5	-10					
Salobo I	Vale	Brazil		20	100	127	127		127
Salobo II	Vale	Brazil				10	75		127
Tucuma	Minercao Caraiba	Brazil			5	10	15		20
KSM	Seabridge	Canada							NP
Schaft Creek	Copper Fox Metals	Canada							NP
Galore Creek	Nova Gold	Canada							NP
Prosperity	Taseko Mines	Canada				33	57		59
Mount Milligan Gold/Copper Deposit	Terrane Metals Corp	Canada				10	20		30
Los Bronces 61-148kt/d Exp	Anglo American	Chile	0	0	50	100	190		200
Los Pelambres expansion	Antofagasta	Chile	50	80	90	90	90		90
Esperanza Project	Antofagasta	Chile	20	80	190	190	190		190
Cerro Casale	Barrick / Kinross	Chile					20		80
Andacollo	Teck/Aur Resources	Chile	20	75	75	75	75		75
Escondia - 3rd conc	BHP Billiton / Rio Tinto	Chile							120
Chuqi u/g	Codelco	Chile							175
Andina - Phase 1	Codelco	Chile							20
El Teniente expansion	Codelco	Chile					100		200
Ministro Hales	Codelco	Chile				20	150		170
Tres Valles	Vale	Chile	2	15	18	18	18		18
Sierra Gorda	Quadra FNX Mining	Chile							NP
Caserones	Pan Pacific	Chile				50	130		180
Lomas Bayas II	Xstrata	Chile	0	5	35	75	75		75
Lomas Bayas I (closure)	Xstrata	Chile			-40	-60	-75		-75
El Morro	Gold Corp / New Gold	Chile					30		80
Collahuasi - Phase 1	Xstrata / Anglo	Chile			5	10	10		10
Collahuasi - Phase 2	Xstrata / Anglo	Chile							NP
Mutoshi	Anvil	DR Congo	0	0	0	10	20		20
Kinsevere Stage II	Anvil	DR Congo	0	20	45	60	60		60
Luita	CAMEC/ENRC	DR Congo	0	0	0	20	60		80
Kinsenda restart	Copper Resources	DR Congo	54	54	54	54	54		54
Ruashi Etoile	Metorex	DR Congo	20	35	35	35	35		35
Kamoto/KOV Restart	Katanga/Glencore	DR Congo				65	110		140
Mirador	Corriente Resources	Ecuador							NP
Skouries Gold Mine	European Goldfields	Greece			10	15	20		25
Boschekul	Kazakhmys	Kazakhstan					30		60
Inca de Oro	Pan Aus / Codelco	Laos					10		25
El Arco	Southern Copper	Mexico							40
Cananea SX EW III and exp	Southern Copper	Mexico					25		60

Note: NP means mine not producing till 2015 but considered in our analysis for longer-term production  
Source: Company guidance, Standard Chartered Research



Fig 36: New copper projects (Cont'd)

Mines	Company	Country	Cumulative Supply (m tonnes)					
			2010E	2011E	2012E	2013E	2014E	2015E
Cananea (new conc)	Southern Copper	Mexico						20
Oyu Tolgoi	Ivanhoe/Rio Tinto	Mongolia				30	100	200
Reko Diq - W Porphyry	Antofagasta / Barrick	Pakistan						20
Cobre Panama	Inmet Mining (80%)	Panama						NP
Frieda River	Xstrata	PNGuinea						NP
Marcona	CST	Peru					30	900
Quellaveco	Anglo American	Peru			0	0	0	50
Michiquillay	Anglo American	Peru			0	0	0	NP
Rio Blanco	Monterrico/Zijin	Peru						NP
Galeno	Jiangxi Copper	Peru						NP
Toromocho	Chinalco	Peru				50	125	225
La Granja	Rio Tinto	Peru					0	0
Cuajone conc exp	Southern Copper	Peru				30	72	72
Toquepala Conc Expansion	Southern Copper	Peru			25	30	65	65
La Caridad expansion	Southern Copper	Peru				15	45	50
Los Chancas	Southern Copper	Peru						NP
Tia Maria	Southern Copper	Peru		20	80	120	120	120
Haquira Copper	Antares Minerals	Peru						10
Canariaco Norte	Candente Copper Corp	Peru						NP
Constancia	Norsemont Mining	Peru						30
Antamina Expansion	Xstrata/Teck	Peru			5	30	50	50
Las Bambas	Xstrata	Peru						200
Antapaccay expansion	Xstrata	Peru			10	40	50	50
Tampakan	Xstrata/Zijin (Indophil)	Philippines						NP
Silangan	Philex	Philippines					2	50
Rovina Copper Deposit	Carpathian Gold Inc	Romania					15	20
Jabal Sayid	Citadel Resources	Saudi Arabia				20	60	57
Las Cruces	Inmet Mining	Spain	10	60	69	70	70	70
Aitik Expansion	New Boliden	Sweden		10	15	25	25	25
Rosemont Copper Mine	Augusta Resource	USA			50	50	50	100
Morenci ramp-up	Freeport	USA		25	55	55	55	55
Pebble	NDM / Anglo	USA						NP
Pumkin Hollow	Nevada Copper	USA					5	20
Muliashi	China Non-Ferrous	Zambia			10	40	60	60
Konkola North	ARM / Vale	Zambia				10	25	44
Konkola to 400kt	Vedanta	Zambia	10	60	120	150	150	150
<b>Cumulative New Copper Production</b>			<b>181</b>	<b>584</b>	<b>1,161</b>	<b>1,847</b>	<b>2,975</b>	<b>4,558</b>
<b>New incremental copper capacity</b>			<b>181</b>	<b>403</b>	<b>577</b>	<b>686</b>	<b>1,128</b>	<b>1,584</b>
<b>Depletion and production misses</b>			<b>(205)</b>	<b>(235)</b>	<b>(195)</b>	<b>(195)</b>	<b>(195)</b>	<b>(195)</b>
<b>YoY increase / (decrease) in supply</b>			<b>(24)</b>	<b>168</b>	<b>382</b>	<b>491</b>	<b>933</b>	<b>1,389</b>

Note: NP means mine not producing till 2015 but considered in our analysis for longer term production  
Source: Companies, Standard Chartered Research estimates



## Thermal coal – Race for ‘power’

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- The era of cheap thermal coal appears to be coming to an end rapidly.
- The seaborne market could be in significant deficit until 2015.
- Export price likely to return to \$150/tonne near term; \$200/tonne in the medium term?
- Australian port expansions may be delayed
- Indonesian coal is being diverted to Indonesian power stations – less is available for exports.
- Domestic mine expansions in India and China could miss targets.

*Thermal coal markets are likely to be in deficit at least till 2015 – even on our conservative China and India demand growth assumptions – due mainly to lower-than-expected Australian and Indonesian supply*

We believe thermal coal prices are on the verge of a major move up. Even assuming conservative growth in China's and India's power-generating capacity, it is difficult for us to see how their mines can deliver enough coal to power their expansion programmes. Coal imports could be the only answer, but it is difficult to see how traditional producers such as Indonesia and Australia will be able to deliver enough coal. Mongolia is a very exciting new coal province to us, but it lacks the infrastructure needed to deliver big tonnage into the China market. Mozambique is also potentially huge, but again, its rail and port infrastructure will likely take another 5 years to be developed over and above the current capacity of 7m tonnes (presently devoted to coking coal).

Unlike copper, getting export coal out of the ground is easy. Moving it out of Australia, South Africa, Mozambique, Mongolia and Indonesia to China and India however, is where the problem lies. Building port and rail infrastructure is difficult and we think the big expansion plans are too optimistic. In the meantime, traditional coal producers such as Indonesia, Vietnam and South Africa all need more coal for their own power needs. Net-net, we do not think there is enough seaborne coal to sustain generating growth of 6% in China and 8% in India. Something would have to give and we think it is most likely to be generating capacity. Daily blackouts in major cities will likely become ever more common and the days of cheap coal to power appear to be coming to an end. It would be a matter of time before governments are forced to bite the bullet and pass on higher electricity tariffs to consumers.



Fig 37: Thermal coal supply &amp; demand

(m tonnes)	Standard Chartered forecasts						
	2009	2010E	2011E	2012E	2013E	2014E	2015E
<b>Supply</b>							
Australia	139	140	149	158	172	184	203
Columbia	63	65	67	69	78	80	82
China	22	20	9	1	0	0	0
Indonesia	233	242	261	277	288	299	314
Russia	78	79	80	81	82	83	80
South Africa	66	62	74	81	80	77	73
United States	19	19	20	21	24	27	28
Vietnam	21	24	26	20	15	10	0
Mongolia	0	1	2	3	4	4	7
Mozambique	0	0	1	1	2	3	4
ROW	10	21	20	25	25	25	25
<b>Global supply</b>	<b>651</b>	<b>674</b>	<b>708</b>	<b>736</b>	<b>770</b>	<b>792</b>	<b>816</b>
<i>yoy growth (%)</i>		3.5%	5.0%	4.0%	4.6%	2.9%	3.1%
<i>yoy growth (mt)</i>		23	34	28	34	22	24
<b>Demand</b>							
China	60	85	96	105	120	131	147
India	58	73	85	98	112	127	143
Japan	109	115	118	118	118	118	118
Taiwan	56	59	61	65	66	67	70
South Korea	83	86	86	87	88	89	90
Vietnam	0	0	0	0	0	0	5
Other Asia	55	57	59	60	61	62	63
Europe	172	162	166	165	163	163	163
ROW	56	49	48	44	42	40	37
<b>Global demand</b>	<b>648</b>	<b>685</b>	<b>719</b>	<b>741</b>	<b>769</b>	<b>796</b>	<b>836</b>
<i>yoy growth (%)</i>		5.7%	5.0%	3.1%	3.8%	3.5%	5.0%
<i>yoy growth (mt)</i>		37	34	22	28	27	40
<b>Surplus/ (Deficit)</b>	<b>4</b>	<b>(11)</b>	<b>(11)</b>	<b>(4)</b>	<b>1</b>	<b>(4)</b>	<b>(19)</b>

Source: Company, Standard Chartered Research estimates

## Race for 'power'

This section provides a detailed country-by-country analysis of demand and supply and shows why we believe the coal markets are likely to be very tight for at least the next five years. It does not take much for coal markets to tighten significantly from here. For now, the markets are nervous about Beijing's attempts to restrain power intensity by less-efficient heavy industry. We think Beijing is wise to curtail some of these energy-hungry factories as it recognises that the market is very tight. At the same time, we think Beijing is waking up to the fact that its mines are getting older and more than 80% of their production comes from underground mines, which are going deeper and becoming more dangerous to operate.

Presently, China imports less than 3% of the coal it needs. This compares with 60% for iron ore and 50% for oil. Beijing knows that if it increases coal imports too quickly, this would send seaborne international prices sky high, which in turn would pressure local prices. It is a balancing act, but even assuming 6% growth in generating capacity (a highly conservative assumption), coal consumption would still need to grow from 3,021m tonnes in 2010 to 3,790m tonnes by 2015. This is equivalent to coal production from five Australia's or three Indonesia's. We assume that 10% of that coal will come from imports. On that basis, China's net imports would need to double to 159m tonnes by 2015.





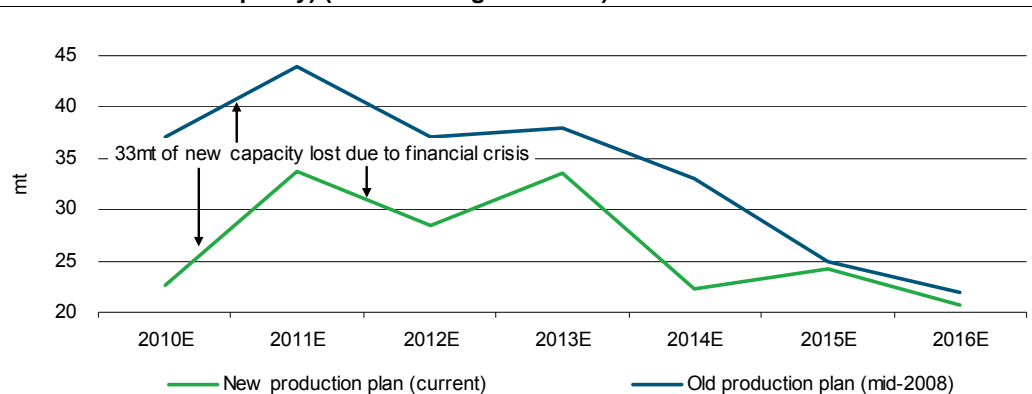
The same is true for India. Assuming power generation growth of 8% and that 40% of its coal needs come from imports, its net imports of coal would need to grow from 73m tonnes in 2010 to 143m tonnes by 2015.

Net-net, we expect thermal coal imports to China and India to grow by 20.5% and 18.0% CAGR conservatively in the next 5 years, implying an additional seaborne demand of 143m tonnes from China and 89m tonnes from India. That implies 232m tonnes of new demand, and compares with our most optimistic seaborne supply forecast of 188m tonnes by 2015. Clearly, we can only hope for delays in the new generating capacity as this does not leave any upside surprises from other consumers such as Taiwan, Japan, Korea, or Europe for that matter.

### The 2008 financial crisis delayed 33m tonnes of new mines

While the impact of the 2008 financial crisis on thermal coal was not as significant as it was on iron ore and copper, the industry still experienced 33m tonnes of projects delayed due to lack of financing and a loss of confidence from producers. This is equivalent to 5% of today's seaborne trade, which compares with the 19% of copper supply lost and the 40% of iron ore supply delayed after 2008. The lesser impact on supply is due mainly to Indonesia continuing to ramp up production during the downturn. This was in part due to significant funding from India and China power consortiums, which continued to invest directly into the mining operations during the downturn. Also unlike Australia, Indonesia has the advantage of being able to expand capacity relatively cheaply as it relies on trucking and barging as opposed to the bigger ticket rail and port. Nevertheless, 33m tonnes is still a big number in our view, and these delays are effectively what have pushed the coal markets firmly into deficit going forward.

**Fig 38: Thermal coal supply forward curve – Old vs new production plans (YoY incremental capacity) (33mt missing near term)**



Source: Standard Chartered Research estimates

### China – thermal coal imports could double by 2015

We applaud Beijing's decision to attempt to restrain power intensity by less-efficient heavy industry and as a result, have used a conservative growth forecast of just 6% for generating capacity. Part of this decision comes from the reality that the rate of growth in China's domestic coal production from 2.2bn tonnes in 2005 to over 3bn tonnes today is unsustainable. For 2010, we estimate net imports will account for about 3% of China's total coal usage – 97% of it coming from its own mines. This compares with iron ore and oil, where imports account for over 60% and 50% of total consumption respectively.

*Chinese coal accidents and consolidation could limit production growth*

**Fig 39: China – Power generation capacity and coal imports**

Demand drivers	2009	2010E	2011E	2012E	2013E	2014E	2015E
Electricity Generated (GW)	874	926	982	1,041	1,103	1,170	1,240
Growth in Electricity Generating Capacity		6%	6%	6%	6%	6%	6%
Coal-fired Generating Capacity %	80%	80%	79%	78%	77%	75%	74%
Coal-fired Electricity Generated (GW)	699	741	776	812	850	877	917
Conversion: Coal (mt) for 1GW	4	4	4	4	4	4	4
Total Coal Requirement (mt)	2,800	2,965	3,103	3,248	3,398	3,509	3,670
Increase in Annual Coal Requirement from 2009 level		165	303	448	598	709	870
% of Imports to meet domestic requirement	2%	15%	12%	10%	10%	10%	10%
<b>Thermal imports (mt)</b>	<b>60</b>	<b>85</b>	<b>96</b>	<b>105</b>	<b>120</b>	<b>132</b>	<b>147</b>
Change YoY (mt)		25	12	8	15	12	15
Change YoY (%)		41%	14%	9%	14%	10%	11%

Source: China Power Ministry, Standard Chartered Research estimates

Assuming conservative growth of 6% pa in China's electricity generation from 944GW in 2010 to 1,263GW in 2015 (70% of which would be coal fired), the country would need to find an additional 769m tonnes of coal in the next five years. This is equivalent to adding five Australia's or three Indonesia's at their current production levels. The supply numbers are staggering, which leads us to believe that something needs to give. Our model assumes that 10% of that 769m tonnes will need to come in the form of imports (it is already running closer to 15% year to date). This would mean that net imports may need to grow from 82m tonnes to 159m tonnes by 2015. Clearly, China has a tough balancing act – if it buys too much imported coal, this would raise the seaborne coal price too high. If price limits are placed on their own producers, then this might stymie growth in capacity. It's a double-edged sword, in our view. So far the government's answer has been to pass on the costs to the Chinese IPP producers, which have suffered from higher coal prices but lower regulated selling prices. We do not expect this policy to change anytime soon as it is still better to encourage domestic coal production by allowing a relatively free market coal price.

For the bears, we illustrate in Figure 40 that on a much more conservative assumption of 4% growth in electricity generation capacity, China would need an extra 42m tonnes of thermal coal imports over the next five years, growing to 114m tonnes of net imports by 2015. Such an environment would basically assume Chinese GDP of less than 5%, in which case coal prices would be weak globally anyway.

**Fig 40: China – Potential growth of electricity generation and coal required**

Year	4% growth				6% growth				8% growth			
	Electricity generated (GW)	Coal required (mt)	Cum. increase in coal required	Total Annual Imports	Electricity generated (GW)	Coal required (mt)	Cum. increase in coal required	Total Annual Imports	Electricity generated (GW)	Coal required (mt)	Cum. increase in coal required	Total Annual Imports
2010	926	2,965	165	85	926	2,965	165	85	926	2,965	165	85
2011	963	3,045	245	89	982	3,103	303	96	1,001	3,162	362	103
2012	1,002	3,126	326	93	1,041	3,248	448	105	1,081	3,371	571	117
2013	1,042	3,210	410	101	1,103	3,398	598	120	1,167	3,641	841	144
2014	1,084	3,251	451	105	1,170	3,509	709	131	1,260	3,781	981	158
2015	1,127	3,336	536	114	1,240	3,670	870	147	1,361	4,029	1,229	183

Source: Standard Chartered Research estimates

**Nuclear – not likely to fill the void in the near or long term**

The potential dramatic increase in China's coal imports over the next five years would suggest that nuclear would be a longer-term solution...or would it? According to the World Nuclear Association, China has 24 nuclear power reactors under construction presently. The contribution from nuclear energy to the national grid is expected to grow from less than 1% (around 10GW) to about 6% (60–70GW) by 2020, based on the forecasts from KPMG and IEA. This represents a



little less than one year's growth in coal-fired capacity. The building cost of nuclear vis-à-vis coal is the major hurdle. In China, a 1,000MW nuclear plant costs around \$3.0bn to construct, about 4-5 times more than it would cost to build the same coal-powered capacity. The lead time for the construction of a nuclear plant is also significantly longer, taking up to five years for planning and approval and another five years for construction. This compares with just two years for a coal-fired station. This explains why uranium prices are still depressed – it is simply too expensive and too long dated. Once the nuclear plant is built, it is of course a much better option, partly because it is a very clean technology and also because the feedstock costs are a fraction of putting 4m tonnes (\$400m at today's market price) of coal into a 1,000MW plant each year. Recently, the uranium price rallied some \$7/pound to nearly \$50/pound, but we believe these moves are likely to be more muted near term than for coal. In reality, the coal price may need to reach \$200/tonne before nuclear becomes a viable and more pressing option.

### India races to secure future coal supplies

*Indian coal production is stranded due to lack of freight rail network; new coastal power plants are built to use imported coal*

India hopes to grow its power generation capacity by 14% pa till 2012, increasing its capacity from 170GW in 2010 to 220GW in 2012 (we forecast 198GW). If India meets even half of its power generation targets, the thermal coal market would face huge problems. Today, coal-fired capacity represents 53% of total installed capacity or some 94GW. Over the next three years, if we assume a more conservative growth forecast of 8%, capacity should grow to 109GW. This in turn means net imports of coal could grow from 58m tonnes in 2009 to 98m tonnes by 2012, which is a 17% increase in current seaborne demand. By 2015, these imports could grow to 143m tonnes. The numbers are staggering in our view, and India would be competing with China as both countries seek to secure imported coals.

### 40% of India's future coal needs may come from imports

Our forecasts assume that 40% of all additional demand comes from imported coal. This is much higher than the 10% assumption we have used for China's build-out programme. Unlike China, India cannot simply fast-track developments. Coal mines take many years to gain mining licences and approvals while the transportation bottlenecks are much more severe in India than in China. In reality, India is likely to rely heavily on imported coal especially from the coastal power plants (ultra mega power projects), which on paper are designed to use 100% imported coal. Regardless of the outcome, assuming India sources 60% of the coal it requires from its mines, it would still need to build an additional 106m tonnes of coal capacity in the next five years. This is double Australia's planned expansion over the same period and over two-thirds of Indonesia's planned growth. It is a large number and it clearly highlights why Indian consortia are spending so much money on buying coal projects in Indonesia, Australia and Mozambique.

**Fig 41: India – Power generation and thermal coal imports**

Demand drivers	2009	2010E	2011E	2012E	2013E	2014E	2015E
Electricity Generated (GW)	159	170	184	198	214	231	250
Growth in Electricity Generating Capacity		7%	8%	8%	8%	8%	8%
Coal-fired Generating Capacity %	53%	55%	55%	55%	55%	55%	55%
Coal-fired Electricity Generated (GW)	84	94	101	109	118	127	137
Conversion: Coal (mt) for 1GW	4	4	4	4	4	4	4
Total Coal Requirement (mt)	337	374	404	437	471	509	550
Increase in Annual Coal Requirement from 2009 level		37	67	100	134	172	213
% of Imports to meet domestic requirement	17%	40%	40%	40%	40%	40%	40%
<b>Thermal imports (mt)</b>	<b>58</b>	<b>73</b>	<b>85</b>	<b>98</b>	<b>112</b>	<b>127</b>	<b>143</b>
Change yr/yr (mt)		15	12	13	14	15	16
Change yr/yr (%)		26%	16%	15%	14%	13%	13%

Source: Government of India – Power Ministry, Standard Chartered Research estimates



Figure 42 shows that on a bearish demand growth assumption of 6% pa, India's thermal coal imports would increase from 73m tonnes in 2010 to 124m tonnes by 2015. This still represents a healthy 51m tonnes of additional demand, and is about 35% of all additional seaborne supply of 142mt. On the flip side, on a bullish 10% pa growth assumption for power generation capacity, India's coal imports could grow by as much as 125% to 164m tonnes by 2015, which would push prices well above \$200/tonne. Like China, India is now playing a delicate balancing act to avoid a spike in international coal prices, which in turn would pressure domestic prices (which are at a significant discount).

**Fig 42: India – Potential growth of electricity generation and coal required**

Year	6% growth				8% growth				10% growth			
	Electricity generated (GW)	Coal required (mt)	Cum. increase in coal required	Total Annual Imports	Electricity generated (GW)	Coal required (mt)	Cum. increase in coal required	Total Annual Imports	Electricity generated (GW)	Coal required (mt)	Cum. increase in coal required	Total Annual Imports
2010	170	374	37	73	170	374	37	73	170	374	37	73
2011	180	397	60	82	184	404	67	85	187	412	75	88
2012	191	421	83	91	198	437	99	98	206	453	116	104
2013	203	446	109	101	214	471	134	112	226	498	161	122
2014	215	473	135	112	231	509	172	127	249	548	211	142
2015	228	501	164	124	250	550	213	143	274	603	266	164

Source: Standard Chartered Research estimates

## Indonesia needs more coal for itself

*Growth in Indonesia's coal exports will likely moderate going forward as the country needs to fuel its aggressive power expansion plans*

In reality, Indonesia is facing power shortages given a population of 300m and an economy growing at near double digits. Our model assumes that state and private consortia will build 12.4GW of new electricity generating capacity over the next five years, taking the installed capacity from 30GW to 42.4GW. The government has two growth programmes: 10GW in Phase 1 (100% coal fired) and 10GW in Phase 2 (50% coal fired). There are always delays in bringing generating capacity online, given the fears of private consortia that they will face pricing restrictions. We have been conservative in our projections and have assumed that Phase 1 will be commissioned by 2014 and Phase 2 will achieve its target by end-2020 (with coal still being the preferred option in the initial rollout phases). Figure 43 illustrates that if Indonesia does build the additional 12.4GW of installed capacity, it would need 49m tonnes of incremental coal by 2015. We do believe that is a genuine prospect. In the past, the cynics argued that Indonesia has always missed on its build-out targets. However, today, Indonesia is booming, its currency is strong and the government appears genuine about wanting grow capacity on the grid. If it does need another 49m tonnes of coal in the next five years, that would almost be like creating a new Taiwan or India on last year's import numbers.

**Fig 43: Indonesia – Power generation and thermal coal exports**

Supply drivers	2009	2010E	2011E	2012E	2013E	2014E	2015E
Electricity Generated (GW)	31	32	34	35	38	41	43
New Electricity Generating Capacity (GW) (100% coal)		1.3	1.3	1.8	3.0	3.0	2.0
Coal-fired Generating Capacity % of grid	18%	22%	26%	31%	39%	46%	50%
Coal-fired Electricity Generated (GW)	6	7	9	11	15	19	22
Conversion: Coal (mt) for 1GW		4	4	4	4	4	4
New Coal Requirement (mt)		5	5	7	12	12	8
Domestic Coal Consumption	30	35	40	47	59	71	79
Domestic Coal Production	254	277	301	324	347	370	394
Growth in Production (%)		9%	8%	8%	7%	7%	6%
<b>Thermal Exports (mt)</b>		<b>242</b>	<b>261</b>	<b>277</b>	<b>288</b>	<b>299</b>	<b>314</b>
Change YoY(%)			8%	6%	4%	4%	5%
Exports as a % of total production		87%	87%	85%	83%	81%	80%

Source: Ministry of Mineral Resources (Indonesia), Standard Chartered Research estimates

## But are Indonesia's coal production plans too ambitious?

*Indonesian coal mines are getting more expensive to operate; new projects are in interior Kalimantan and require higher coal prices*

As coal power stations are being commissioned, we believe the Indonesian miners may struggle to reach their target of adding another 160m tonnes over the next five years. This would mean growth in production from 254m tonnes in 2009 to 414m tonnes by 2015. For our modelling purposes, we have assumed that they will achieve 93% of their target, but even then, we are being conservative and would not be surprised if the number were closer to 60% or around 100m tonnes. The reality is that coal mining is becoming increasingly more challenging for all the Kalimantan producers for many reasons:

- **Ageing mines:** First, Indonesian coal miners are currently mining at a very high strip ratio of around 12:1. This implies that for every tonne of coal mined, each producer needs to move an additional 12 tonnes of waste material. Some mines, we believe, are operating at strip ratios of as high as 16:1, almost unheard of in traditional Australian or South African coal operations, which would have gone underground to reduce the strip ratio. In Indonesia, labour is cheaper but even then, it is a lot of earth to move, which is expensive especially as the quality of coal is declining. We believe that the strip ratio will rise even higher as the mines get deeper.
- **Logging restrictions:** In May 2010, the Indonesian government announced a two-year moratorium on new logging concessions as a part of a deal with Norway, for which Indonesia will receive up to \$1bn. We are not really sure what this means or whether it is aimed more at the palm oil producers. But it is another issue that can delay projects.
- **New mines going further inland:** As new coal mines are developed, producers are forced to go further inland on the island of Kalimantan. This makes barging more difficult and costly, especially during the dry months. The further miners go inland the more likely delays begin to occur.
- **Falling quality of coal:** Nearly all of Indonesia's planned 160m tonnes of new capacity is sub-bituminous coal with low calorific value (4,800–5,000 kcal/kg) and higher ash/water content. As a result, ships will need to carry more coal with less calorific value. All this adds to higher costs, which push up the marginal cost of production.

## Very little new coal available from Indonesia from 2014

Figure 44 illustrates the plans of the Indonesia's miners to add nearly 60% of new capacity by 2015. As we said, we have assumed 93% of this capacity will reach their targets by 2015, but this number could easily slip. More importantly, most of this new capacity is back-end loaded and is not likely to impact the market until 2014 onwards.

**Fig 44: Indonesia – Coal production (m tonnes)**

Producer (m tonnes)	2010E	2011 E	2012 E	2013 E	2014 E	2015 E
Bumi	72	91	104	104	105	107
Adaro	46	50	55	65	70	80
ITMG	23	23	23	24	24	25
Indika	32	37	40	44	49	53
Bayan	14	15	16	17	18	20
Strait Asia Resources	10	13	15	18	18	18
PT Bukit Asam	14	15	17	19	22	27
Berau Coal	18	20	24	28	31	34
Others	49	51	51	56	59	65
<b>Total</b>	<b>277</b>	<b>315</b>	<b>345</b>	<b>374</b>	<b>396</b>	<b>429</b>
SC forecast used for modelling	100%	95%	94%	93%	94%	92%
<b>Forecast total capacity</b>	<b>277</b>	<b>301</b>	<b>324</b>	<b>347</b>	<b>370</b>	<b>394</b>
Forecast annual additions	16	19	15	18	34	45
Domestic coal consumption needs	35	40	47	59	71	80
<b>Total coal available for export</b>	<b>242</b>	<b>261</b>	<b>277</b>	<b>288</b>	<b>299</b>	<b>314</b>
<b>Exports – incremental YoY</b>	<b>7</b>	<b>18</b>	<b>16</b>	<b>11</b>	<b>11</b>	<b>15</b>

Source: Company guidance, Standard Chartered Research estimates

## Australian port and rail expansion plans too optimistic?

*Australia has the potential to add 70m tonnes of new capacity, but it needs more than A\$4bn in investment on infrastructure especially rail, to cope with the production increases*

Mining projects take longer to come onstream, particularly in Australia. The country currently boasts 21 thermal coal projects, which could add as much as 85m tonnes by 2018. At the same time, it has 17 coking coal projects, which are targeted to add 52m tonnes over the same period. This is a huge volume of coal to move but we do not think the port and rail expansions will come onstream early enough to feed these proposed start-ups. Queensland's annual rail capacity, for example, is only 189m tonnes while that of the ports stands at 205m tonnes. In New South Wales, Newcastle's port capacity is 113m tonnes while its rail capacity is only 91m tonnes.

The Queensland government is planning a major upgrade of its rail and port operations. We estimate the total capital cost to be around A\$5 billion to add an additional 133m tonnes of port capacity and 140m tonnes of rail. In the first phase, work started on the 69km Northern Missing Link, which is being constructed at a capital cost of A\$1bn. Connecting the Goonyella region (currently serviced by Haypoint and Dalrymple ports) to the Abbot Point terminal, the project is expected to be completed by 2012 although that could slip by a year or two. At the same time, the state government hopes to expand the Abbott Point terminal from 21m tonnes to 100m tonnes by 2014. We think this is an optimistic target and believe the expansion is likely to be delayed by some two to three years. The expansion would be competing for access to skilled labour with the Wiggins Island Coal terminal development, which is scheduled to add 25m tonnes of new capacity by 2012. Moreover, on a macro scale, these coal terminals would be competing for skilled labour with the Pilbara expansions and massive LNG expansions at North West Shelf and Gladstone.

For thermal coal, we are assuming that the industry will be able to deliver 90% of its planned expansions. We assume Australia's coal exports will grow at a 5.4% CAGR from 140m tonnes in 2010 to 198m tonnes by 2015, compared to 5.6% CAGR from 2004–09.

Xstrata, the largest contributor to the proposed incremental production, has six coal projects in New South Wales, which have the potential to add 36m tonnes pa of new capacity. The company recently announced that its focus in the next few years would be on organic growth, unlike the 'growth through acquisition' policy it had followed over the past decade. The company had \$35bn of projects in the pipeline over the past 3 years but most of these were put on the backburner



after the 2008 financial crisis. Time will tell if the company sticks to its new organic growth policy or if it returns to the M&A market, which has served it so well in the past.

On a different issue, coal miners briefly suspended their exploration and development work in Australia on the announcement of the Resources Super Profit Tax. The amendment of the proposed tax to the Mineral Resources Rent Tax (MRRT) is likely to allow most of these projects to go ahead, although a few delays may occur as some of the miners return to the drawing board to ascertain the revised profitability and return on these projects. Net-net, this is a red herring, in our view.

**Fig 45: Australia – New projects (production in m tonnes)**

Project	Company	2010E	2011E	2012E	2013E	2014E	2015E
Isaac Plains	Aquila	0.2	0.2	0.2	0.4	0.4	0.4
Maules Creek	Aston Resources			0.3	2.0	4.0	5.2
Mt. Arthur expansion - MAC 20	BHP		0.5	1.5	2.5	3.5	3.5
Minyango	Caledon						0.5
Airly	Centennial Coal	0.3	1.0	1.5	1.7	1.7	1.7
Baralaba/Bowen Basin	Cockatoo Coal	0.0	0.1	0.1	0.5	0.8	1.0
Woori project (Surat Basin)	Cockatoo Coal						1.8
Stratford and Duralie	Gloucester Coal	0.3	0.5	0.5	0.5	0.5	0.5
Alpha coal project	Hancock coal				1.5	3.0	5.0
New Acland (Stage 3)	New Hope	0.3	0.5	0.8	0.8	0.8	0.8
Elimatta	Northern Energy				0.5	1.0	1.5
Wambo expansion - NSW	Peabody Energy			0.5	1.0	1.5	2.5
Wilpinjong expansion - NSW	Peabody Energy			0.3	0.5	1.0	1.5
Clermont mine - Darymple	Rio Tinto	0.5	2.0	4.0	6.0	8.0	10.0
Gunnedah & Werris Creek	Whitehaven		0.5	1.0	1.3	1.3	1.3
Narrabri	Whitehaven		1.0	2.0	4.0	5.0	6.0
Blakefield South	Xstrata	1.5	4.0	4.0	4.0	4.0	4.0
Mangoola	Xstrata			1.0	4.0	7.0	8.0
Ulan West	Xstrata					1.0	2.5
Ravensworth North	Xstrata						1.5
Newlands Northern u/g	Xstrata			1.0	2.0	3.0	3.0
Wandoan Coal	Xstrata						3.0
Yancoal	Yancoal	1.5	2.5	5.0	5.0	5.0	8.0
<b>Total Australia</b>		<b>4.5</b>	<b>12.8</b>	<b>23.4</b>	<b>36.2</b>	<b>48.5</b>	<b>67.9</b>
<b>Total Australia – SC estimates (assuming 90%)</b>		<b>4.1</b>	<b>11.5</b>	<b>21.0</b>	<b>32.6</b>	<b>43.6</b>	<b>62.8</b>

Source: Company data, Standard Chartered Research estimates



## South Africa – struggling to feed domestic demand

*We expect South African exports to remain flat at best, given the expansion programme of Eskom consuming most of the new production*

We expect South Africa's thermal coal exports to increase only modestly from 62m tonnes in 2010 to 73m tonnes in 2015 as the country intends to increase its power generation capacity rapidly to plug the deficit.

**Fig 46: South Africa – Power generation and potential thermal coal exports**

Supply drivers	2009	2010E	2011E	2012E	2013E	2014E	2015E
Electricity Generated (GW)	37	38	38	38	39	40	42
New Electricity Generating Capacity (GW)		0.6	0.2	0.2	1.0	1.4	1.4
Conversion: Coal (mt) for 1GW		4	4	4	4	4	4
New Coal Requirement (mt)		2	1	1	4	6	6
Domestic Coal Consumption	149	151	152	153	157	163	168
Domestic Coal Production	211	214	226	234	237	239	241
Growth in Production (%)		1%	6%	4%	1%	1%	1%
<b>Thermal Exports (mt)</b>		62	74	81	80	77	73
Change YoY (%)			18%	10%	-1%	-5%	-5%
Exports as a % of total production		29%	33%	35%	34%	32%	30%

Source: Company, Standard Chartered Research estimates

We show in Figure 47 ESKOM's power projects that are scheduled for commissioning in the next 5 years. ESKOM has plans to increase power capacity by 8GW, which would create an additional annual demand of 32m tonnes of coal. We conservatively assume that only 60% of the proposed capacity will come onstream in the next 5 years, creating an incremental demand of 19m tonnes pa.

**Fig 47: ESKOM – power generation expansion plans**

Plant (MW)	Grootvlei	Komati	Arnot	Medupi	Kusile	Total
2009/2010	800	125	70			995
2010/2011		325	30			355
2011/2012		300				300
2012/2013				1,588		1,588
2013/2014				794	1,600	2,394
2014/2015				1,588	800	2,388
<b>Total</b>	<b>800</b>	<b>750</b>	<b>100</b>	<b>3,970</b>	<b>2,400</b>	<b>8,020</b>

Source: ESKOM

South Africa's thermal coal production is expected to continue to increase in line with the historical average (2000–09) of 1–2% pa, in our view. In Figure 48, we list the new coal projects in South Africa.

**Fig 48: South Africa – New coal projects (production in m tonnes)**

Project	Company	2010E	2011E	2012E	2013E	2014E	2015E
Zibulo (previously Zondagsfontein)	Anglo American		4.4	6.6	6.6	6.6	6.6
Douglas/Middelburg	BHP	0.5	1.0	2.0	4.0	6.0	8.0
Klipstruit - Expansion	BHP	0.5	1.0	1.8	1.8	1.8	1.8
Mooiplaats	CoAL	1.7	2.5	3.0	3.0	3.0	3.0
Atcom	Xstrata		1.0	3.0	4.0	4.0	4.0
Goedgevonden Colliery	Xstrata	0.0	5.0	6.8	6.8	6.8	6.8
<b>Total South Africa</b>		<b>2.7</b>	<b>14.9</b>	<b>23.2</b>	<b>26.2</b>	<b>28.2</b>	<b>30.2</b>

Source: Company data, Standard Chartered Research estimates

We forecast a modest increase in exports from 62m tonnes in 2010 (29% of total production) to 73m tonnes (30% of total production) on our conservative assumption that only 60% of the

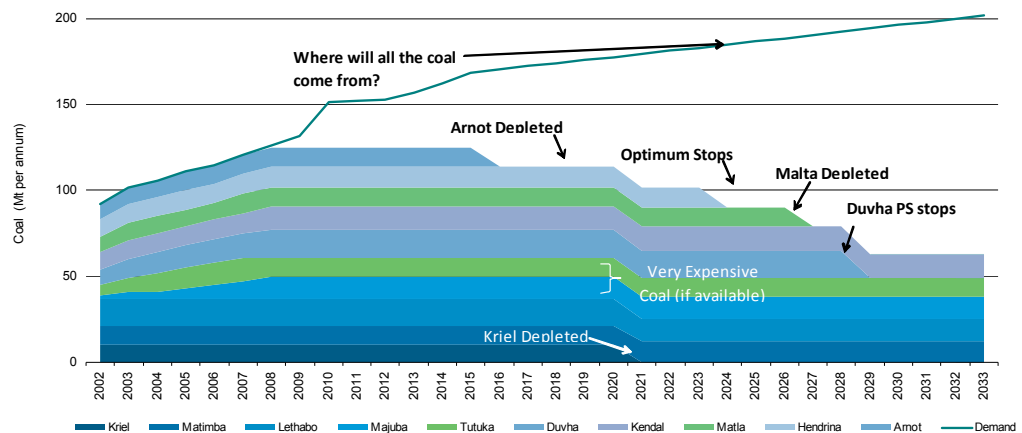




proposed new power generation capacity will come onstream in the next 5 years. If the country were to commission 100% of its proposed expansion plans, exports could fall from 62m tonnes in 2010 to 60m tonnes or 25% of total production by 2015.

ESKOM estimates that South Africa needs 40 new coal mines by 2020, ie. two new coal mines every year. We estimate that only six projects will be commissioned in the next 5 years, which could potentially add 30m tonnes of new capacity, well below the estimated 40m tonnes of new coal capacity required to feed ESKOM's massive new power plants at Medupi and Kusile (4,800MW each).

**Fig 49: Availability of coal to ESKOM's power stations**



Source: Exxaro Resources Limited (Coaltrans Asia 2010, Bali), Standard Chartered Research estimates

South Africa produced about 72m tonnes of export coal in 2009, but only 66m tonnes were exported due to rail constraints. Transnet Freight Rail, which transports coal from the mines to the port terminal, has a capacity of only 68m tonnes pa, although Richards Bay Coal Terminal can handle 91m tonnes pa. Transnet has committed to increase capacity to 80m tonnes pa over the next five years as part of its Quantum Leap project. However, this would still leave a 10m tonne gap in the supply chain. Further, labour trouble as witnessed by the rail strike in May this year and problems with cable theft and locomotive breakdowns will likely be a drag on exports.

## Mozambique potentially massive for thermal coal, but...

*Rail infrastructure likely to limit the production in the Tete basin to 7m tonnes in the near term when it has the potential to be a 100m tonne coal basin*

Alongside Mongolia, the Tete coal province is the best undeveloped coal basin in the world, in our view, which on paper could be a 100m tonne pa coal province within 20 years. What is so exciting about this province is that it is home to mega coal deposits with seams up to 60 metres thick. These are the kind of deposits South African and Australian producers can only dream of now. But the main issue here is infrastructure. As a guide, China's industry is mining an average coal seam thickness of only 3–4 metres.

First shipments out of the Tete basin are expected at the end of 2011 and they will be restricted to 7m tonnes pa of mainly coking coal until 2015/16 when the 20m tonne port expansion at Beira is completed (assuming the \$560m project is developed on time with financing from the EU). On June 24, Wuhan Iron and Steel joined the growing list of equity participants in Riversdale by acquiring an 8% stake for \$200m and promising an additional \$800m in the Bemba project. Basically, Wuhan is paying \$800m for the right to acquire 10% of all future coking coal produced from Riversdale's Benga project and an additional 40% from any other new mines it builds on the Zambeze concessions. Tata Steel came early to the game, acquiring a 22% stake in the company as well as forming a JV with Riversdale to develop the Benga and Tete coal tenements. Tata has a 35% interest in the project as well as a 40% share of the off-take for coking coal.



Brazilian iron ore and steel producer CSN also completed a 16% purchase of Riversdale new shares in early 2010 at a premium to the prevailing share price at that time.

Vale's Moatize project will take the lion's share of tonnage on the existing single gauge railway. We have no doubt that both Vale's and Riversdale's projects have the potential to be scaled up to become world-class coal operations over time. However, for now, they will likely make only a small dent in the global coking and thermal coal markets until proper infrastructure is developed.

**Fig 50: New thermal coal projects (production in million tonnes)**

Project	Company	Country	2010E	2011E	2012E	2013E	2014E	2015E	2016E
Isaac Plains	Aquila	Australia	0.2	0.2	0.2	0.4	0.4	0.4	0.4
Maules Creek	Aston Resources	Australia			0.3	2.0	4.0	5.2	4.5
Mt. Arthur open cut expansion	BHP	Australia		0.5	1.5	2.5	3.5	3.5	3.5
Minyango	Caledon	Australia						0.5	1.0
Airly	Centennial Coal	Australia	0.3	1.0	1.5	1.7	1.7	1.7	1.7
Baralaba/Bownen Basin	Cockatoo Coal	Australia	0.0	0.1	0.1	0.5	0.8	1.0	1.0
Woori project (Surat Basin)	Cockatoo Coal	Australia						1.8	3.0
Stratford and Duralie	Gloucester Coal	Australia	0.3	0.5	0.5	0.5	0.5	0.5	0.5
Alpha coal project	Hancock coal	Australia				1.5	3.0	5.0	10.0
New Acland (Stage 3)	New Hope	Australia	0.3	0.5	0.8	0.8	0.8	0.8	0.8
Elimatta	Northern Energy	Australia				0.5	1.0	1.5	4.0
Wambo expansion - NSW	Peabody Energy	Australia			0.5	1.0	1.5	2.5	3.0
Wilpinjong expansion - NSW	Peabody Energy	Australia			0.3	0.5	1.0	1.5	2.0
Clermont mine	Rio Tinto	Australia	0.5	2.0	4.0	6.0	8.0	10.0	12.2
Gunnedah & Werris Creek	Whitehaven	Australia		0.5	1.0	1.3	1.3	1.3	1.3
Narrabri	Whitehaven	Australia		1.0	2.0	4.0	5.0	6.0	6.0
Blakefield South	Xstrata	Australia	1.5	4.0	4.0	4.0	4.0	4.0	4.0
Mangoola	Xstrata	Australia			1.0	4.0	7.0	8.0	8.0
Ulan West	Xstrata	Australia					1.0	2.5	5.0
Ravensworth North	Xstrata	Australia						1.5	3.0
Newlands Northern u/g extension	Xstrata	Australia			1.0	2.0	3.0	3.0	3.0
Wandoan Coal	Xstrata	Australia						3.0	5.0
Yancoal	Yancoal	Australia	1.5	2.5	5.0	5.0	5.0	8.0	10.0
Sherritt Intl	Sherritt Intl	Canada	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Western Canadian	Western Canadian	Canada	0.9	2.0	3.1	4.6	4.6	4.6	4.6
Huangyuchuan mine	China Shenhua	China	1.0	2.5	3.5	4.5	5.5	6.5	8.0
Shandong Daliuta underground	China Shenhua	China		1.0	2.5	3.5	4.5	5.5	6.5
Huojitu mine at Daliuta (upgrade)	China Shenhua	China		2.5	3.5	5.5	8.5	10.5	12.5
Yulin Shenhua Guojiawan	China Shenhua	China			2.0	2.5	3.5	4.5	6.0
Gahoe production (100%)	Gahoe	China	1.5	3.0	6.0	6.0	6.0	6.0	6.0
Wara and Tutupan deposits	Adaro Energy	Indonesia	4.0	9.0	15.0	25.0	30.0	35.0	35.0
Banpu Public Co Ltd.	Banpu	Indonesia	2.0	5.0	5.0	5.0	5.0	5.0	5.0
Bayan	Bayan	Indonesia	3.1	3.1	0.8	0.8	0.8	2.4	2.4
Berau Coal	Berau Coal	Indonesia		2.5	4.0	3.5	3.5	3.5	3.5
PT Bukit Asam	PT Bukit Asam	Indonesia	2.4	1.4	1.5	1.7	3.7	4.5	4.5
Kideco (46%)	Indika	Indonesia	4.3	4.3	4.3	4.3	4.3	4.3	4.3
Kideco (46%)	Indika	Indonesia		5.0	5.0	5.0	5.0	5.0	5.0
Santan Batubara (50%)	Indika	Indonesia	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Indominco	ITMG	Indonesia	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Jorong	ITMG	Indonesia	-1.1	0.0	0.0	0.0	0.0	0.0	0.0
Kitadin	ITMG	Indonesia	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Trubaindo	ITMG	Indonesia	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Pakar Thermal Coal	Kangaroo Resources	Indonesia		1.0	2.0	2.0	2.0	2.5	3.0
PT Bumi	PT Bumi	Indonesia	2.0	8.0	17.0	25.0	30.0	35.0	35.0
Jembayan	Straits	Indonesia	1.5	2.5	3.5	5.0	5.0	5.0	5.0
Sebuku	Straits	Indonesia	-0.2	1.5	2.5	4.0	4.0	4.0	4.0
MEC Coal	MEC Coal	Indonesia					5.0	17.0	17.0

Source: Company guidance, Standard Chartered Research

**Fig 50: New thermal coal projects (production in million tonnes) (cont'd)**

Project	Company	Country	2010E	2011E	2012E	2013E	2014E	2015E	2016E
Berau Thermal Coal Project	Strike	Indonesia	0.3	0.8	1.0	1.5	2.0	2.5	3.0
Ulaan Ovoo Coal Project	Prophecy Resource Corp	Mongolia	0.2	1.0	1.5	2.0	2.0	2.0	2.0
South Gobi	South Gobi	Mongolia	1.0	1.0	1.0	1.0	1.0	3.0	3.0
Other projects		Mongolia				1.0	1.0	2.0	2.0
Benga	Riversdale Mining	Mozambique		0.2	0.4	0.8	1.2	1.6	1.6
Moatize Project	Vale SA	Mozambique		0.3	0.6	1.2	1.8	2.4	2.4
Other Mozambique		Mozambique							1.0
Zibulo (previously Zondagsfontein)	AngloAmerican	South Africa		4.4	6.6	6.6	6.6	6.6	6.6
Douglas/Middelburg	BHP	South Africa	0.5	1.0	2.0	4.0	6.0	8.0	10.0
Klipstruit - Expansion	BHP	South Africa	0.5	1.0	1.8	1.8	1.8	1.8	1.8
Mooiplaats	CoAL	South Africa	1.7	2.5	3.0	3.0	3.0	3.0	3.0
Atcom	Xstrata	South Africa		1.0	3.0	4.0	4.0	4.0	4.0
Goedgevonden Colliery	Xstrata	South Africa	0.0	5.0	6.8	6.8	6.8	6.8	6.8
Tunnel Ridge Coal Mine	Alliance Resource Partners	United States		1.0	2.0	4.0	6.0	6.0	6.0
Cloud Peak	Cloud Peak	United States				1.0	2.0	3.0	4.0
Prodeco expansion	Glencore AG	Columbia				7.0	7.0	7.0	7.0
Other		Columbia	2.0	4.0	6.0	8.0	10.0	12.0	0.0
<b>Total new supply</b>			<b>38.8</b>	<b>97.2</b>	<b>147.4</b>	<b>206.2</b>	<b>251.6</b>	<b>310.5</b>	<b>327.3</b>
<i>Incremental new supply yr/yr</i>			<i>38.8</i>	<i>58.4</i>	<i>50.2</i>	<i>58.8</i>	<i>45.4</i>	<i>59.0</i>	<i>16.8</i>
			<b>6%</b>	<b>15%</b>	<b>23%</b>	<b>32%</b>	<b>39%</b>	<b>48%</b>	<b>50%</b>
<b>Declining mines</b>									
Blair Athol	Rio Tinto	Australia	-3.3	-2.0	-1.0	-1.0	-1.0	-1.0	-1.0
<b>Declining Supply yr/yr</b>			<b>-3.3</b>	<b>-2.0</b>	<b>-1.0</b>	<b>-1.0</b>	<b>-1.0</b>	<b>-1.0</b>	<b>-1.0</b>
<b>Change in Supply yr/yr</b>				<b>56.4</b>	<b>49.2</b>	<b>57.8</b>	<b>44.4</b>	<b>58.0</b>	<b>15.8</b>

Source: Company guidance, Standard Chartered Research



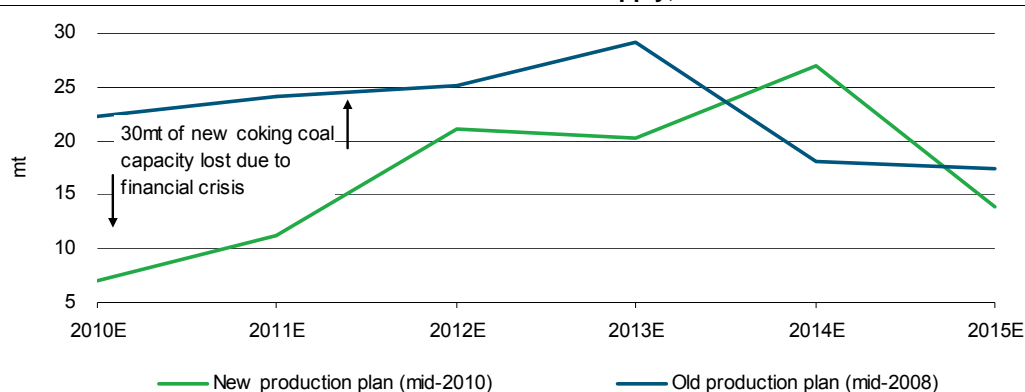
## Coking coal – Mongolia the key swing factor

- Coking coal price could spike to \$350/t on limited supply from 2010–12.
- Mongolia – most exciting new coking coal province.
- Mozambique – restricted to just 7m tonnes near term.
- BMA (BHP), world's largest coking coal producer, running to a standstill in the past five years.
- Chinese production plagued by coal mine accidents and production stoppages.
- India intends to double its steel production by 2012–13, but does not have quality coking coal.

*BMA, world's largest coking coal producer, has been running to a standstill in the last 5 years*

From our analysis, there are presently only 36 recognised coking coal projects in the world. Most of these projects are in the very early stages of production and we estimate they will bring only 27m tonnes (12%) of current capacity over the next 3 years. Mongolia is the largest new entrant in the market and we expect it to deliver one in every three new tonnes of coking coal over the next 5 years. Mozambique has enormous potential, but is limited to about one in every six new tonnes, largely due to a lack of rail and port infrastructure. The market also looks particularly good because the largest producer, BMA (BHP-Mitsubishi), which represents 20% of seaborne trade, has been very slow to invest in new projects and will bring on virtually no new capacity in the next 4 years. Even Teck, the second largest producer, was forced to delay expansion as its balance sheet was too stretched after the 2008 financial crisis. All of its projects were delayed by at least 12 months, and new capacity is only just beginning to hit the market. We think coking coal prices have the potential to spike back to their early 2008 highs of \$350/tonne.

**Fig 51: Coking coal – New vs old production plans (YoY incremental production): Industry set to lose 30mt or 14% of current seaborne supply, in our view**



Source: Standard Chartered Research estimates

Figure 51 illustrates the impact of the 2008 financial crisis on near-term supply in the coking coal industry. Some 30m tonnes of new capacity or 14% of current seaborne supply that was supposed to come onstream over the next 3 years is now delayed until 2013 and onwards. During the downturn in 2008 and early 2009, the industry invested in only critical/high yield projects while construction plans for the low-yield/high capital-intensive projects were either shelved or suspended. In 2010, our forecast supply growth of 8.6% is largely from the restart of idled mines, especially in Australia. This surge in idled capacity has temporarily softened the market after the spike earlier in the year, when Rospadskaya was forced to shut its 8m tonne coking coal mine, which takes 5m tonnes out of this year's supply and 3m tonnes from 2011 (we expect it to restart in Q2'11).



Fig 52: Coking coal supply &amp; demand

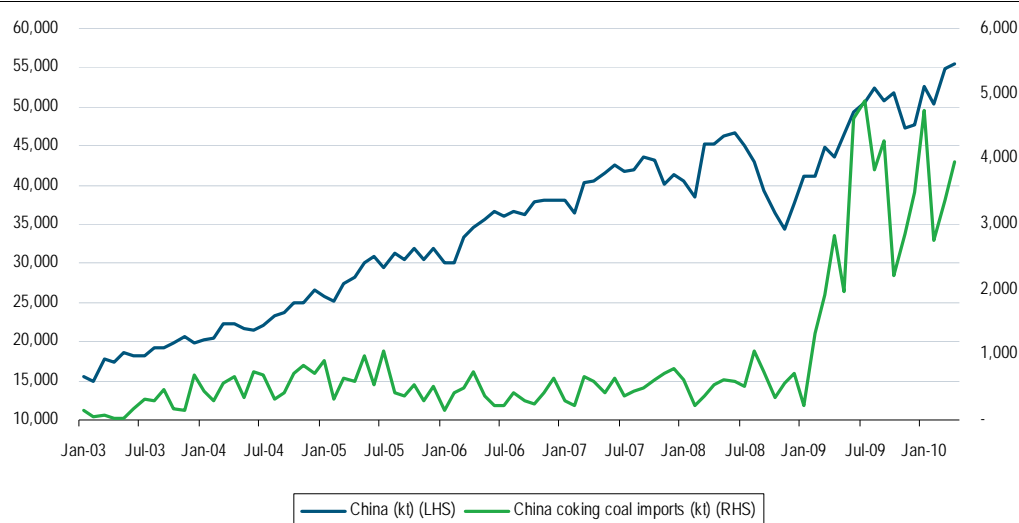
(m tonnes)	Standard Chartered Forecasts (m tonnes)						
	2009	2010E	2011E	2012E	2013E	2014E	2015E
<b>Supply</b>							
Australia	126	134	135	141	146	158	166
USA	33	33	34	36	36	36	36
Canada	26	27	29	31	34	34	33
Russia	15	10	13	18	21	24	24
South Africa	2	3	3	3	4	7	10
Mozambique	0	0	0	2	5	6	6
Mongolia	3	10	13	17	21	27	28
Indonesia	6	6	6	8	9	11	12
Poland	1	1	1	1	1	1	1
ROW	16	19	19	19	19	19	20
<b>Global supply</b>	<b>228</b>	<b>243</b>	<b>254</b>	<b>275</b>	<b>296</b>	<b>323</b>	<b>337</b>
<i>yoy growth (%)</i>		6.5%	4.6%	8.3%	7.4%	9.2%	4.3%
<i>yoy growth (mt)</i>		15	11	21	20	27	14
<b>Demand</b>							
Japan	66	75	78	80	82	85	87
South Korea	15	17	18	19	19	19	20
China	34	37	39	42	45	46	48
India	28	37	38	41	44	45	47
Belgium	2	3	3	3	3	3	3
France	4	4	4	4	5	5	5
Germany	7	8	8	8	8	8	8
Italy	6	7	7	7	7	7	7
UK	5	6	6	7	7	7	7
ROW	52	63	70	75	86	88	94
<b>Global demand</b>	<b>220</b>	<b>258</b>	<b>271</b>	<b>286</b>	<b>307</b>	<b>313</b>	<b>326</b>
<i>yoy growth (%)</i>		17.2%	5.1%	5.5%	7.3%	2.2%	4.1%
<i>yoy growth (mt)</i>		38	13	15	21	7	13
<b>Surplus/ (Deficit)</b>	<b>8</b>	<b>(15)</b>	<b>(17)</b>	<b>(11)</b>	<b>(11)</b>	<b>9</b>	<b>10</b>

Source: Company data, Standard Chartered Research estimates

## Modest Chinese steel production growth is all we need

*Gone are the days of double-digit steel production growth in China; but even modest growth should keep the coking coal market in deficit*

China was historically an exporter of coke produced utilising source material from its domestic mines. This all changed in 2009 when it turned into a significant net importer of 34m tonnes of coking coal on a strong steel production recovery from Q2'09. While the era of 15% pa steel production growth in China is gone, our mild outlook of 5–6% growth in 2011 could still be enough to push the coking coal market firmly into deficit for at least the next 3 years. So far this year, China's steel production growth is on track to achieve growth of around 10% or about 625m tonnes. In the first half, annualised steel production was actually 640m tonnes, so we believe we have a relatively conservative view with our full-year forecast, which factors in the recent destocking cycle in June and July. Assuming 10% steel production this year, China is on track to grow net imports of coking coal from 34m tonnes to 37m tonnes (again a very conservative number if we see a recovery in China's steel production in Q4'10). So far, Mongolia has proved a major source of new supply, with imports of coking coal increasing from 4m tonnes in 2009 to 5.8m tonnes already to the month of June 2010. We think annual imports from Mongolia will hit 10m tonnes, a significant jump from last year. In fact, Mongolia is really the only near-term supply source for the China market.

**Fig 53: China monthly steel production vs monthly coking coal imports**

Source: World Steel Association

## Mongolian coal has huge potential to deliver into China

*Mongolia is one of the most exciting new mining frontiers in the world, in our view*

We have three investor trips to Mongolia in September this year, which gives an indication of how important we think this region is becoming. In the past, Mongolia attracted very little foreign investment, largely due to its discount to seaborne prices (lack of access to seaborne market and dependence on China) and a lack of stability in mining regulation. This is all changing and we now regard Mongolia as one of the best new mining frontiers for foreign investment. There are already several significant discoveries in Mongolia that have similar geology to the Bowen basin (coking coal rich) in Australia. Mongolia has three recognised coking coal producers: Mongolian Energy Corporation (first production late August 2010), Energy Resources and SouthGobi Resources. It also has several unlisted and smaller backyard operations. We expect collective production to grow to nearly 28m tonnes by 2015, from around 10m tonnes in 2010.

## Producers can sell every tonne they produce

We think the Mongolian producers are starting up production at exactly the right time as China's dependence on net imports has surged since the start of 2009. Going forward, the true test of Mongolia's potential will be the prices it receives from Chinese customers. For now, all three producers are selling raw coal (unwashed) and the average discount to the Australian export price is around 40–60%. This is dependent on the location of each mine and the agreements they have with either the middleman at the border or the steel customer. In reality, the Mongolians have no choice but to sell their coking coal to the Chinese, as they are captive to that market (unless they sell to the Russians). For now, producers truck the coal from the mines to the Mongolian border, they then unload on the Chinese side and it is then reloaded onto a Chinese truck. The whole exercise adds \$20–60 to the Mongolian's cost, in effect reducing the selling price by the same amount. This compares with a mining cost of only \$20–25/tonne, which is by far the lowest in the world.

If China surprises us next year by again delivering steel production growth of double digits (we forecast 5–6%), then prices of Mongolian coal may jump considerably and be sold at a much lower discount to the Australians. This, in turn, would encourage even more production growth, although, for now, the capacity limitation is trucking (there is no rail into China). Figure 54 details the growth plans of the three new producers.

**Fig 54: New coking coal projects in Mongolia**

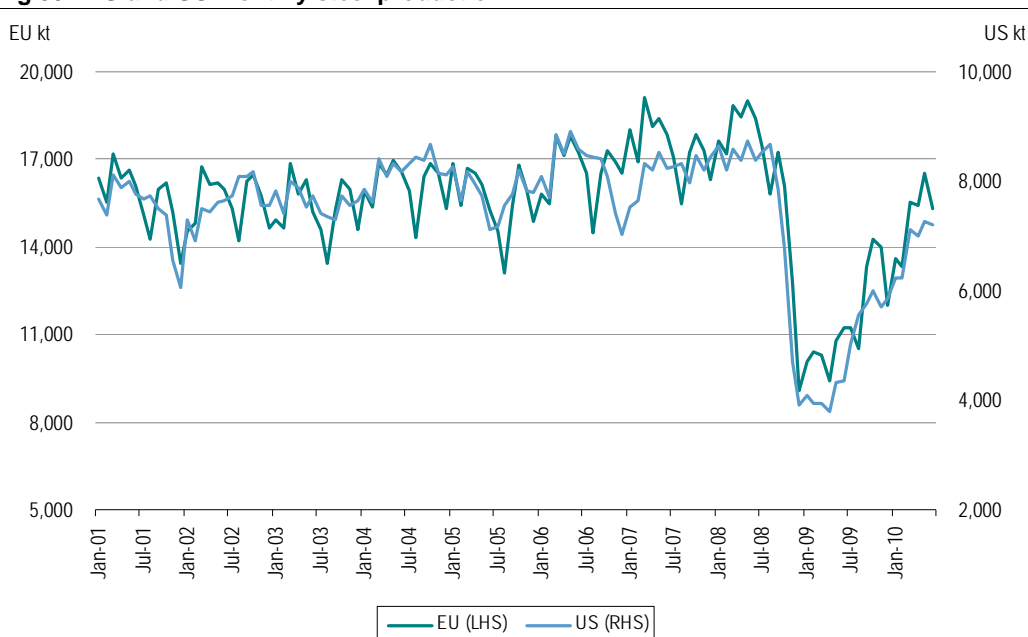
Project	Company	2010E	2011E	2012E	2013E	2014E	2015E	2016E	2017E
Ovoot Tolgoi	South Gobi	2.0	2.5	3.5	4.0	4.0	4.0	4.0	4.0
Soumber	South Gobi			1.0	3.0	5.0	5.0	5.0	5.0
Khushuut	Mongolia Energy Corp	0.4	1.4	2.8	3.4	5.8	5.8	5.8	5.8
Ukhaa Khudag	Energy Resources	3.0	4.0	5.0	6.0	7.0	8.0	8.0	8.0
Others		4.6	5.0	5.0	5.0	5.0	5.0	5.0	5.0
<b>Total</b>		<b>10.0</b>	<b>12.9</b>	<b>17.3</b>	<b>21.4</b>	<b>26.8</b>	<b>27.8</b>	<b>27.8</b>	<b>27.8</b>

Source: Company guidance, Standard Chartered Research

## What if Europe/US steel producers recover?

*If US steel markets continue to improve, US coking coal shipments that are going to China could divert back to the US*

Our coking coal model is based on the assumption that the US and Europe will continue to bumble along at around 75% capacity utilisation. This is a typical mid-cycle level of capacity utilisation and does not take into account any recovery where utilisation could quickly climb back to +80%. If the US and Europe actually surprise us on the upside, then the 10m tonne deficit that we forecast could grow to 20m tonnes very quickly and squeeze prices. That is the interesting part of this market. We are all so focused on India and China that we tend to forget the upside surprises that could occur in the 'old economies'.

**Fig 55: EU and US monthly steel production**

Source: World Steel Association

## Indian coking coal demand could potentially double by 2013

*India needs to import coking coal to feed its ambitious growth programme for its steel production*

India imports nearly all of its coking coal requirements. It has ambitious plans to double its steel capacity from 60m tonnes in 2009 to 120m tonnes by end-2012. Even if we assume that only 50% of the proposed new capacity comes onstream in the next 3 years, India would still require 22m tonnes of incremental seaborne supply, which is more than 50% of the potential new global coking coal capacity. There is significant scope for increased steel consumption in India, as the country's per-capita consumption of steel is only 40kg compared with global consumption of 150kg and Chinese consumption of 250kg per capita. The Indian government intends to spend \$1trn on infrastructure in the next 5 years, doubling the \$500bn spent in the last 5 years. Under government plans, the intention is to double the steel capacity to 120m tonnes by 2012 and further roughly double to 250m tonnes in the subsequent 5 years. We believe that "walking the

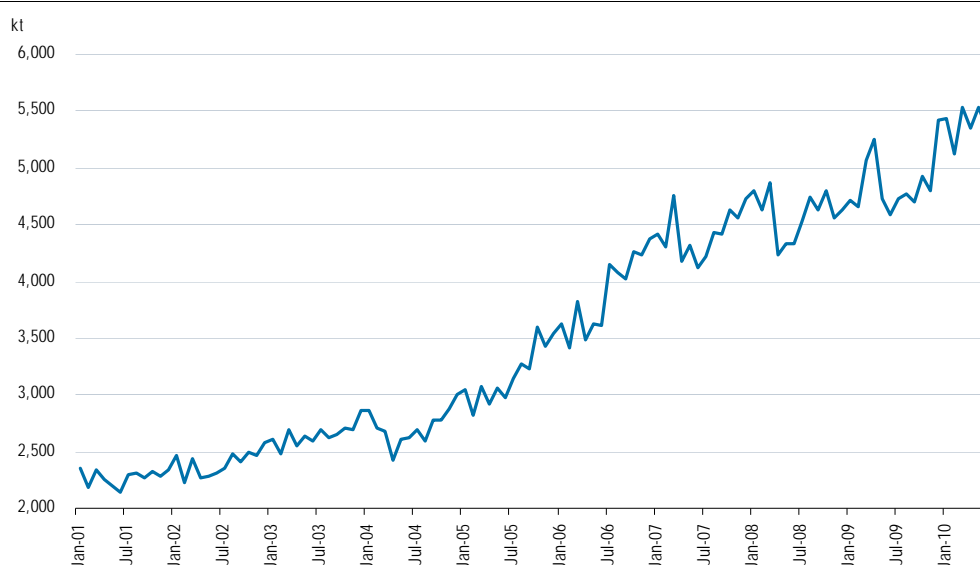




walk” would be difficult however, given the recent problems faced by steel companies such as Arcelor Mittal and Posco in developing their large-scale steel plants and their associated iron ore mines. These projects, which already were significantly delayed, faced stiff opposition from locals on land acquisition deals.

There is no good-quality hard coking coal resource available in India and the country has to depend on Australia, and further down the track Mozambique (when Riversdale begins production) for its coking coal. Coal India Limited, the world largest coal company, and Tata Steel have started acquiring tenements in Mozambique and Australia to secure their coking coal supply for the future, but this will take several years to become a reality given the lack of rail and port capacity.

**Fig 56: Indian monthly steel production (since Jan 2001)**



Source: World Steel Association

## Infrastructure constrains Australian expansion plans

Australia is the largest exporter of coking coal in the world. The country's exports have, however, remained flat in the past 3 years at around 130m tonnes. The infrastructure bottlenecks at the Bowen Basin in Queensland, the richest coking coal region in the world, have hampered the expansion plans of the miners.

As discussed in the “Thermal coal” section, the Queensland government is planning a major upgrade of its rail and port operations. We estimate the total capital cost to be around A\$5 billion to add an additional 133m tonnes of port capacity and 140m tonnes of rail. In the first phase, work has just started on the 69km Northern Missing Link, with construction at a capital cost of A\$1bn, which will connect the Goonyella region (currently serviced by Haypoint and Dalrymple ports) to the Abbot Point terminal. Completion of the project is scheduled for 2012, although we think that could slip by a year or two. At the same time, the state government hopes to expand the Abbott Point terminal from 21m tonnes to 100m tonnes by 2014. We think this is a very optimistic view and believe the expansion is likely to be delayed. The expansion will be competing for skilled labour access with the Wiggins Island Coal terminal development, which is scheduled to add 25m tonnes of new capacity by 2012. Moreover, in the bigger picture, these coal terminals would compete for skilled labour with the Pilbara expansions and massive LNG expansions at North West Shelf and Gladstone. Coal producers will clearly try and ship as much coking coal at the expense of thermal coal, given the huge price differential, but if Abbot Point terminal is not ready, that point would be academic.

**Fig 57: New coking coal projects in Australia (production in m tonnes)**

Project	Company	2010E	2011E	2012E	2013E	2014E	2015E	2016E	2017E
Daunia	BHP Billiton						1.0	2.5	2.5
Caval Ridge	BHP Billiton					2.0	3.5	5.5	5.5
Peak Downs	BHP Billiton					0.5	1.0	2.5	2.5
Goonyella Riverside expansion	BHP Billiton							4.0	6.0
Saraji East	BHP Billiton						0.8	2.0	2.0
Eagle Downs	Aquila Resource					1.0	2.5	3.5	3.5
Washpool	Aquila Resource						0.5	1.6	1.6
Belvedere	Vale							1.0	2.5
Grosvenor	Anglo American				1.0	2.5	3.5	4.3	4.3
Middlemount	Macarthur			1.0	2.5	4.0	4.0	4.0	4.0
Stratford and Duralie	Gloucester Coal								
Kestrel extension	Rio Tinto			0.2	0.9	1.3	1.7	1.7	1.7
Donkin	Xstrata/Erdene				0.4	1.2	1.8	2.4	2.4
Minyango	Caledon Resources				0.8	1.5	1.7	1.7	1.7
Maryborough	Northern Energy Corp		0.3	0.5	0.5	0.5	0.5	0.5	0.5
Maules Creek	Aston Resources			3.0	3.5	6.1	5.0	5.8	6.1
NRE1	Gujarat NRE Coke		0.2	1.0	1.3	2.5	2.7	2.7	2.7
NRE Wongawilli expansion	Gujarat NRE Coke		0.8	0.9	0.7	0.6	2.2	2.2	2.2
<b>Total</b>		0.0	1.3	6.6	11.6	23.7	32.4	47.9	51.7

Source: Company guidance, Standard Chartered Research

### BMA's (BHP-Mitsubishi JV) projects have no near-term impact

BMA (BHP Billiton-Mitsubishi JV), which is the largest producer of coking coal in the world, was able to maintain production only in the past seven years. The company's new projects will add incremental production by 2014 at the earliest. Last year, BHP fast-tracked its development of the Caval Ridge and Peak Downs expansion, projects that could bring in 8m tones of new capacity. The company will inject \$267m into the projects to order long lead time materials while feasibility studies are underway.

The Daunia project, which should increase BMA's production capacity by 4m tonnes, was initially slated to commence production from 2011. The company has not received approval from the Environment Ministry, however, and first production looks possible only by 2016, at the earliest. BHP was forced to slow down the development of the project as the rail infrastructure does not currently support mine expansions.

### Mechel's Elga project remains a supply risk

The Elga project in Russia, owned by Mechel, has the potential to produce 30m tonnes of coal (thermal+coking). The project is located in a remote region of Siberia, however, and requires 315km of new rail road to connect the minesite to the nearest infrastructure. Mechel expects to spend \$1.7bn of capex for the development of the project in the next 2 years. The company plans Initial production from the project of 1m tonnes. We think given the remoteness of the location and rough terrain of the railroad, there is significant risk to the production ramp-up to 30m tonnes. Hence we expect the mine to produce only 9m tonnes of coking coal by 2015.

### Mozambique – the hidden jewel

We have visited the Tete coal province at least 20 times in the past 3 years. What is most surprising is the vastness of this coal resource, 10–20 billion tonnes conservatively of primarily thermal coal and some rich coking coal seams, in our view. Unlike Mongolia, which tends to feature pure coking coal deposits, the coking coal in Mozambique tends to be a blend of both thermal and coking. As discussed in the "Thermal coal" section, first shipments out of the Tete



basin are scheduled at the end of 2011. Shipments will be restricted to 7m tonnes per annum of mainly coking coal (70% coking/30% thermal) until 2015/16 when the 20m tonne port expansion at Beira is completed (assuming the \$560m project is developed on time with financing from the EU). On June 24, Wuhan iron and Steel joined the growing list of equity participants in Riversdale following its acquisition of an 8% stake for \$200m. It also promised an additional \$800m in the Bemba project. Wuhan has agreed to pay \$800m for the rights to acquire 10% of all future coking coal produced from Riversdale's Benga project and an additional 40% from any other new mines built on the Zambeze concessions. Tata Steel was early to the game, acquiring a 22% stake in the company as well as establishing a JV with Riversdale to develop the Benga and Tete coal tenements. Tata has a 35% interest in the project, as well as a 40% share of the off-take for coking coal. Brazilian iron ore and steel producer CSN also completed a 16% purchase of new shares in Riversdale in early 2010 at a premium to the then share price.

Vale's Moatize project will take the lion's share of tonnage on the existing single gauge railway. We have no doubt that both Vale and Riversdale's projects have the potential to scale up to world-class coal operations over time. For now, however, they will make only a small dent in the global coking and thermal coal markets until proper infrastructure is actually developed. Unlike Mongolia, which is on the doorstep of China, it is simply not economical for now to truck the coking from Tete to the Beira port (especially given Beira is not yet open for handymax ships). An alternative would be to rail the coking coal through Zimbabwe and then down to South Africa and then Richards Bay. But again, this does not really make economic sense and South Africa has its own rail restraints.

**Fig 58: Coking coal new projects (production in m tonnes)**

Project	Company	Country	2010E	2011E	2012E	2013E	2014E	2015E	2016E	2017E
Daunia	BHP Billiton	Australia						1.0	2.5	2.5
Caval Ridge	BHP Billiton	Australia					2.0	3.5	5.5	5.5
Peak Downs	BHP Billiton	Australia					0.5	1.0	2.5	2.5
Goonyella Riverside expansion	BHP Billiton	Australia							4.0	6.0
Saraji East	BHP Billiton	Australia						0.8	2.0	2.0
Eagle Downs	Aquila Resource	Australia					1.0	2.5	3.5	3.5
Washpool	Aquila Resource	Australia						0.5	1.6	1.6
Belvedere	Vale	Australia							1.0	2.5
Grosvenor	Anglo American	Australia				1.0	2.5	3.5	4.3	4.3
Middlemount	Macarthur	Australia			1.0	2.5	4.0	4.0	4.0	4.0
Kestrel extension	Rio Tinto	Australia			0.2	0.9	1.3	1.7	1.7	1.7
Donkin	Xstrata (75%) / Erdene Resources (25%)	Australia				0.4	1.2	1.8	2.4	2.4
Minyango	Caledon Resources	Australia				0.8	1.5	1.7	1.7	1.7
Maules Creek	Aston Resources	Australia			3.0	3.5	6.1	5.0	5.8	6.1
Maryborough	Northern Energy Corp	Australia		0.3	0.5	0.5	0.5	0.5	0.5	0.5
NRE1	Gujarat NRE Coke	Australia		0.2	1.0	1.3	2.5	2.7	2.7	2.7
NRE Wongawilli expansion	Gujarat NRE Coke	Australia		0.8	0.9	0.7	0.6	2.2	2.2	2.2
Various (Fording, Elkview, Quintette)	Teck Resources	Canada	1.0	3.0	5.0	7.5	8.0	7.0	6.0	6.0
Belcourt	Western Coal	Canada							1.0	2.5
Kubah Indah	Kangaroo Resources	Indonesia			1.0	1.5	2.0	2.0	2.0	2.0
Mamahak	Kangaroo Resources	Indonesia	0.2	0.4	0.7	1.0	1.3	1.5	1.5	1.5
Jawana & Borami	Kangaroo Resources	Indonesia			0.2	0.7	1.0	1.0	1.0	1.0
IndoMet Coal Project	BHP (75%)/Adaro (25%)	Indonesia					1.0	1.5	2.0	3.0
Ovoot Tolgoi	South Gobi	Mongolia	2.0	2.5	3.5	4.0	4.0	4.0	4.0	4.0
Soumber	South Gobi	Mongolia			1.0	3.0	5.0	5.0	5.0	5.0
Khushuut	Mongolia Energy Corp	Mongolia	0.2	1.4	2.8	3.4	5.8	5.8	5.8	5.8
Ukhaa Khudag	Energy Resources	Mongolia	3.0	4.0	5.0	6.0	7.0	8.0	8.0	8.0
Other projects		Mongolia	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Moatize	Vale	Mozambique			1.0	2.5	3.5	4.0	5.0	7.0
Benga	Riversdale (65%) / Tata Steel (35%)	Mozambique			1.0	2.0	2.0	2.0	3.0	6.0
Dębieńsko	New World Resources	Poland							1.0	2.0
Elga	Mechel	Russia		1.0	2.5	6.0	9.0	9.0	9.0	9.0
Raspadskaya	Raspadskaya	Russia	-5.0	-3.0						
Vele	Coal of Africa	South Africa	0.5	1.0	1.0	1.0	3.0	5.0	5.0	5.0
Makhado	Coal of Africa	South Africa				1.0	2.0	3.0	5.0	5.0
Vangatfontein (Delmas)	Keaton Mining	South Africa	0.1	0.3	0.4	0.4	0.4	0.4	0.4	0.4
Lubel	Lubel Coal Company	Ukraine						1.0	2.5	4.0
<b>Total from new projects</b>			<b>6.9</b>	<b>18.1</b>	<b>39.2</b>	<b>59.6</b>	<b>86.6</b>	<b>100.6</b>	<b>123.1</b>	<b>136.9</b>
Incremental production YoY			6.9	11.2	21.1	20.4	27.1	14.0	22.5	13.8
Production restarts			8.0	-	-	-	-	-	-	-
<b>Net incremental production</b>			<b>14.9</b>	<b>11.2</b>	<b>21.1</b>	<b>20.4</b>	<b>27.1</b>	<b>14.0</b>	<b>22.5</b>	<b>13.8</b>
<b>Seaborne supply</b>			<b>242.9</b>	<b>254.1</b>	<b>275.2</b>	<b>295.6</b>	<b>322.6</b>	<b>336.6</b>	<b>359.1</b>	<b>372.9</b>

Source: Company guidance, Standard Chartered Research



## Appendix

**Fig 59: Announced project delays immediately announced or flagged after the late 2008 financial crisis**

Project	Country	Company	Commodity	Capex (US\$m)	Capacity
Dubal	Saudi Arabia	Maaden	Aluminium	10,600	740 kt
Aluminium smelter	Mongolia	HMHJ Aluminium	Aluminium	2,200	150 kt
Bogoslovsk	Russia	UC Rusal	Aluminium	4,000	300 kt
Kandalaksha	Russia	UC Rusal	Aluminium	3,500	240 kt
Irkutsk	Russia	UC Rusal	Aluminium	3,000	200 kt
Sredni Timan	Russia	UC Rusal	Aluminium	6,500	500 kt
Taishet	Russia	UC Rusal	Aluminium	7,500	600 kt
Boyne Replacement	Australia	Rio Tinto	Aluminium	617	552 kt
Abu Dhabi Smelter	Abu Dhabi	Rio Tinto	Aluminium	3,000	700 kt
	China	Chalco	Aluminium	584	300 kt
Coega	South Africa	Rio Tinto	Aluminium	6,000	460 kt
<b>Total – Aluminium</b>				<b>47,501</b>	<b>4,742</b>
Mutoshi	DR Congo	Anvil	Copper	200	18 kt
Sepon Copper	Laos	Oz Minerals	Copper	50	20 kt
Dikulushi second phase	DR Congo	Anvil	Copper	17	60 kt
Kinsevere	DR Congo	Anvil	Copper	380	60 kt
Ezperanza South	Australia	Aditya Birla Minerals Ltd.	Copper	20	n/a
Northmet	USA	Polymet	Copper	380	33 kt
Ruashi Etoile	DR Congo	Metorex	Copper	160	35 kt
Pebble	Alaska	Anglo American	Copper	4,500	350 kt
Kinsenda restart	DR Congo	Copper Resources	Copper	100	54 kt
Cerro Casale	Chile	Arizona Star / Kinross	Copper	1,430	113 kt
Cunico	Zambia	Muliashi	Copper	300	60 kt
Petaquilla	Panama	Inmet / Petaquilla / Teck Cominco	Copper	1,708	194 kt
Oyu Tolgoi – Phase 2	Mongolia	Ivanhoe	Copper	1,500	90 kt
Agua Rica	Argentina	Northern Orion	Copper	2,055	182 kt
Galeno	Peru	Northern Peru	Copper	1,000	176 kt
Galore Creek	Canada	Nova Gold / Teck Cominco	Copper	2,000	100 kt
Toromocho	Peru	Peru Copper Inc	Copper	1,600	243 kt
La Granja	Peru	Rio Tinto	Copper	1,500	180 kt
Resolution	USA	Rio Tinto / BHP Billiton	Copper	2,000	200 kt
El Morro	Chile	Xstrata	Copper	1,000	108 kt
Tampakan	Philippines	Xstrata	Copper	1,500	130 kt
El Pachon	Argentina	Xstrata	Copper	1,000	198 kt
Frieda River	PN Guinea	Xstrata	Copper	3,000	225 kt
Las Bambas	Peru	Xstrata	Copper	2,000	257 kt
Kamoto Deep	DR Congo	Katanga	Copper	160	40 kt
Luita Phase 2	DR Congo	Camec	Copper	100	60 kt
KOV Restart	DR Congo	Katanga	Copper	1,700	225 kt
Magistral	Peru	Inca Pacific	Copper	400	34 kt
Copper Smelter	Ain Sokhna	El Sewedy Cables	Copper	850	300 kt
El Abra & Tenke II	Peru / DR Congo	Freeport	Copper	1,560	200 kt
Arizona & Colorado	USA	Freeport	Copper	1,000	100 kt
Muliashi	DR Congo	Luanshya Copper Mines	Copper	354	96 kt
Various projects	Peru	Southern Copper	Copper	3,300	300 kt
Various projects	Mexico	Southern Copper	Copper	1,800	150 kt
<b>Total – Copper</b>				<b>40,624</b>	<b>4,591</b>

Source: Company, Standard Chartered Research

**Fig 59: Announced project delays immediately announced or flagged after the late 2008 financial crisis (Cont'd)**

Project	Country	Company	Commodity	Capex (US\$m)	Capacity
Western Bushveld JV	South Africa	Platinum Group Metals	Platinum	1,000	250 koz
Amandelbult No 4 shaft	South Africa	Anglo American	Platinum	1,602	271 koz
Twickenham	South Africa	Anglo American	Platinum	800	180 koz
Paardekraal	South Africa	Anglo American	Platinum	316	120 koz
Leeuwkop	South Africa	Implats	Platinum	850	200 koz
<b>Total – Platinum</b>				<b>4,568</b>	<b>1,021</b>
Casposo Project	Argentina	Intrepid mines Ltd	Gold	86	70 koz
Toka Tindung Gold Project	Indonesia	Archipelago Resources plc	Gold	67	160 koz
Buffelsfontein	South Africa	Simmern & Jack	Gold	100	80 koz
Martabe	Indonesia	Oz Minerals	Gold	225	100 koz
Orosi	Nicaragua	Central Sun Mining	Gold	41	77 koz
Boddington project	Australia	Newmont Mining Corp	Gold	2,400	850 koz
<b>Total – Gold</b>				<b>2,919</b>	<b>1,337</b>
Nullagine	Australia	BC Iron	Iron ore	80	5 mt
Cape Lambert	Australia	China Metallurgical Corporation	Iron ore	500	6 mt
Sishen South	South Africa	Anglo American	Iron ore	782	9 mt
Sishen Phase 2	South Africa	Anglo American	Iron ore	775	10 mt
Fortescue Phase 2	Australia	FMG	Iron ore	2,000	50 mt
Southdown	Australia	Grange Resources	Iron ore	1,373	7 mt
Karara Magnetite	Australia	Gindalbie Metals / Anshan Iron	Iron ore	1,000	8 mt
Balla Balla	Australia	Aurox Resources	Iron ore	550	10 mt
IOCC	Canada	Rio Tinto	Iron ore	475	8 mt
Simandou	Guinea	Rio Tinto	Iron ore	6,000	70 mt
Corumba expansion	Brazil	Rio Tinto	Iron ore	2,150	12 mt
Pilbara Phase 2	Australia	Rio Tinto	Iron ore	7,000	80 mt
Brockman / Mesa 4	Australia	Rio Tinto	Iron ore	2,401	47 mt
Maquiné-Baú	Brazil	Vale	Iron ore	2,207	24 mt
Carajás Serra Sul	Brazil	Vale	Iron ore	10,094	90 mt
Mbalam project	Cameroon	Sundance Resources	Iron ore	2,460	35 mt
Weld Range	Australia	Midwest / Sinosteel	Iron ore	650	15 mt
Yeristovskoe & GPL	Ukraine	Ferrexpo	Iron ore	2,309	20 mt
MMX-Minas	Brazil	Anglo American	Iron ore	5,000	25 mt
Sishen South – Medium grade	South Africa	Kumba Iron ore	Iron ore	210	3 mt
Belinga	Gabon	CMEC	Iron ore	3,000	25 mt
<b>Total – Iron ore</b>				<b>51,016</b>	<b>559</b>
Altai	Russia	Russian Nickel Co.	Nickel	640	10 kt
Fenix nickel project	Guatemala	Hudbay / Skye Resources Inc	Nickel	640	22 kt
Murrin Murrin expansion	Australia	Minara Resources Ltd	Nickel	196	10 kt
Sholl B2	Australia	Fox Resources	Nickel	150	5 kt
Onca Puma	Brazil	Vale	Nickel	2,297	58 kt
Taganito	Philippines	Sumitomo Metals	Nickel	1,000	30 kt
Yellow Mountain	China	GobiMin Inc	Nickel	476	n/a kt
Moa	Cuba	Sheritt	Nickel	270	10 kt
Ambatovy	Madagascar	Sheritt	Nickel	3,300	60 kt
Eagle	USA	Rio Tinto	Nickel	300	16 kt
Nickel Rim	Canada	Xstrata	Nickel	495	30 kt
Raglan	Canada	Xstrata	Nickel	255	25 kt
Koniambo	New Caledonia	Xstrata	Nickel	3,850	60 kt
Halmehera	Indonesia	PT Aneka / BHP Billiton	Nickel	4,800	60 kt
Several projects	Russia	Norilsk	Nickel	500	n/a kt
<b>Total – Nickel</b>				<b>19,169</b>	<b>396</b>

Source: Company, Standard Chartered Research

**Fig 59: Announced project delays immediately announced or flagged after the late 2008 financial crisis (Cont'd)**

Project	Country	Company	Commodity	Capex (US\$m)	Capacity
Zinc project	Russia	Russian Copper Co.	Zinc	650	300 kt
Black Angel lead-zinc	Greenland	Angus & Ross	Zinc	30	n/a kt
Chelyabinsk	Russia	Chelyabinsk	Zinc	400	200 kt
Mungana	Australia	Kagara Zinc	Zinc	70	20 kt
Brazilian Zinc	Brazil	Votorantim Group	Zinc	281	kt
Perkoa zinc mine	Australia	Aim Resources	Zinc	165	82 kt
<b>Total - Zinc</b>				<b>1,596</b>	<b>602</b>
Bauxite Alumina Project	India	Dubai Aluminium	Alumina	3,600	1,500 kt
Alumina refinery project	India	Utkal Alumina International Ltd	Alumina	889	1,500 kt
Wagerup refinery expansion	Australia	Alcoa / Alumina Ltd	Alumina	4,000	2,100 kt
Mt. Hope	USA	General Moly	Molybdenum	852	17 kt
Climax	USA	Freeport	Molybdenum	300	14 kt
Escondida	Chile	BHP Billiton	Molybdenum	120	4 kt
Aktobe	Kazakhstan	ENRC	Ferrochrome	590	440 kt
Aksu	Kazakhstan	ENRC	Ferrochrome	540	460 kt
Iron ore	Kazakhstan	ENRC	Iron ore	1,820	9 mt
Yaruwin Expansion	Australia	Rio Tinto	Alumina	1,800	2 mt
Aluminium	Kazakhstan	ENRC	Aluminium	985	125 kt
1200MW power plant	Kazakhstan	ENRC	Energy	2,400	1,200 MW
Klipoortjie	South Africa	Xstrata	Coal	75	2 mt
Tweefontein optimisation	South Africa	Xstrata	Coal	350	5 mt
Goedgevonden ramp up	South Africa	Xstrata	Coal	300	4 mt
Zonnenbloem	South Africa	Xstrata	Coal	400	3 mt
Coal gasification plant	Canada	Sherritt International	Coal	3,300	n/a kt
Moolarben project	Australia	Felix Resources Ltd	Coal	400	kt
Clermont	Australia	Rio Tinto	Coal	1,290	12 mt
Kestrel	Australia	Rio Tinto	Coking Coal	991	2 mt
New Largo	South Africa	Anglo American	Coal	670	15 mt
Elders u/g	South Africa	Anglo American	Coal	240	3 mt
<b>Total - Others</b>				<b>25,912</b>	
<b>Grand Total</b>				<b>193,305</b>	

Source: Company, Standard Chartered Research



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## Disclosures appendix

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