



# ICSG - Lisbon

## Long-term Copper Dynamic

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*Passion to Perform*

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Deutsche Bank AG/London

All prices are those current at the end of the previous trading session unless otherwise indicated. Prices are sourced from local exchanges via Reuters, Bloomberg and other vendors. Data is sourced from Deutsche Bank and subject companies. DISCLOSURES AND ANALYST CERTIFICATIONS ARE LOCATED IN APPENDIX 1. MICA(P) 007/05/2010

## Summary View

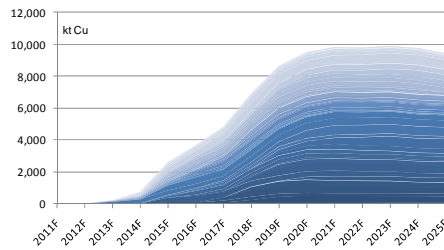


- We estimate that a copper price of USD2.77/lb. is needed to justify the build of new capacity required to supply global markets over the next decade.
- 11mta of additional copper required by 2025; copper demand growth is expected to fall from an average 3.4% (past 50yrs) to 3% going forward.
- Ongoing industrialisation of the developing economies should support demand growth despite some further substitution of copper in some markets in the early part of the decade.
- Cost inflation is structural: Geography (labour/currency/taxes), Geology (degradation of aging mines) and Energy are key components.
- Average future cash costs are expected to be USD0.94/lb. and capital intensity is expected to be USD12,500/t.

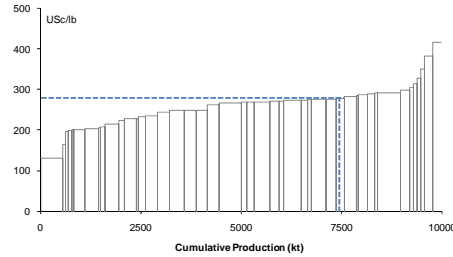
## Future Copper Supply



### Potential copper supply additions



### Copper incentive price curve to achieve 15% IRR



Source: Deutsche Bank

### Summary

- There is enough copper to supply global requirements over the next 10-15 years.
- In fact we expect that a mid-decade surplus is probable.
- In addition to new mine supply; an increase in scrap usage is needed help offset the natural decline in copper production as some current mines exhaust their reserves.
- However, the costs associated with exploitation of these new resources could be significantly higher; in our view a long-term prices of USD2.77/lb is needed.

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3

## Historic Consumption Trends



### Global Copper Growth Rates By Decade vs. Global GDP

Period	Copper CAGR	Global GDP growth rates	Ratio
<b>1946-2010</b>	<b>3.4%</b>		
1946-1950	7.4%		
1950-1960	4.6%		
1960-1970	4.4%		
<b>1970-2010</b>	<b>2.5%</b>	<b>3.6%</b>	<b>0.68</b>
1970-1980	2.7%	4.2%	0.64
1980-1990	1.5%	3.2%	0.45
1990-2000	3.3%	3.2%	1.03
2000-2010	2.4%	3.8%	0.64

Source: Deutsche Bank, IMF, Brook Hunt

### Outlook

- The 1990's appears somewhat anomalous given it is pre-BRIC; The period of sustained growth toward the end of the decade, helped by the more copper intensive telecoms boom in the US and Europe, lead to a relatively strong period of copper demand.
- Copper consumption growth moderated in the past decade, despite the advent of China, due to a moderation in Western Industrial activity and due to the dampening impact of high prices on certain segments of demand.

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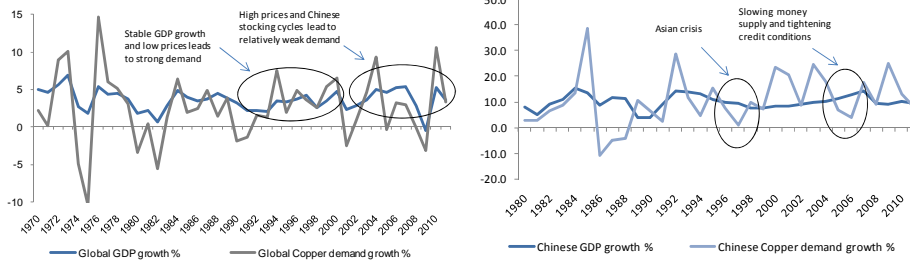
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4

## Historic Consumption Trends



### Copper Demand Growth vs. GDP



Source: Deutsche Bank, IMF, Brook Hunt

### Outlook

- Due to the ongoing industrialisation of the emerging economies, we expect the global copper demand GDP multiplier could be higher than the historic average of 0.68x.

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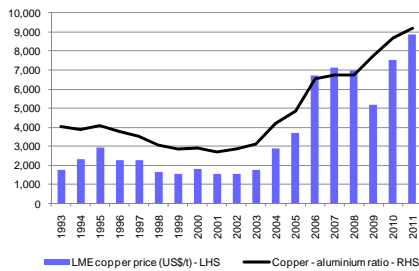
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5

## Copper Substitution



### Copper – Aluminium Ratio

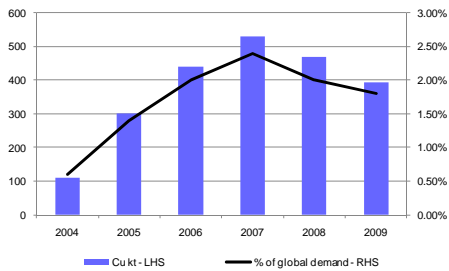


Source: Deutsche Bank, ICA, Brook Hunt, Thomson Reuters

### Outlook

- Copper has superior physical/electrical characteristics to many other materials; vs. aluminium copper is at least 65% more effective than aluminium (electrical/thermal conductivity). Alternatively expressed, beyond a ratio of 1.7x, there is an economic incentive to begin considering substitution. There are other considerations of course – retooling of machinery, space/technical considerations, etc. which pushes this ratio to above 2x.
- The Int'l Copper Assoc estimates that substitution reached 2.2mt between 2004 and 2009 (an average of 1.7% of global demand/annum). We expect that 400-500kt of additional substitution has occurred since this time.

### Copper Substitution Volumes



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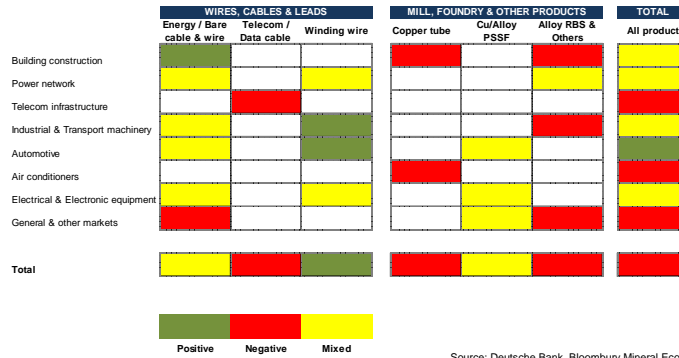
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6

# Substitution – Market Analysis



## Substitution Outlook for Copper



Source: Deutsche Bank, Bloomberg Mineral Economics

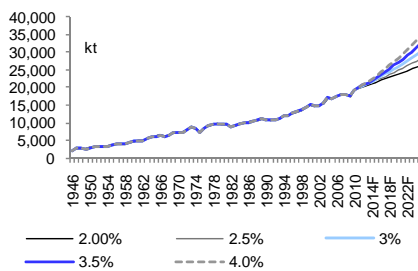
### Outlook

- We would characterise the refrigeration/air-conditioning markets as potentially the next area of significance for further copper substitution. Copper tubing for these applications could potentially be substituted by aluminium alloy.

# Copper Demand and Recycling

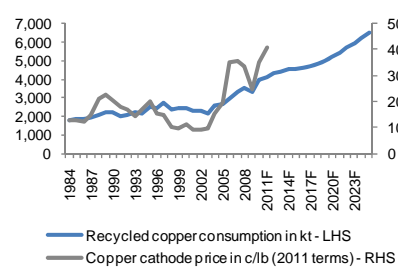


## Copper demand to 2025e



Source: Deutsche Bank, Brook Hunt

## Copper Recycling vs. Price



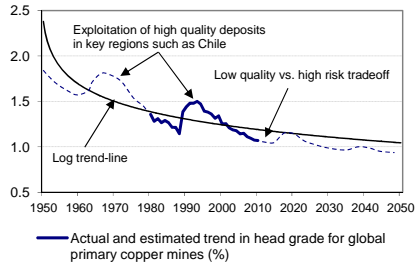
### Outlook

- About 20% of annual copper demand is satisfied with recycled material; this ratio however varies considerably, generally from 14% to 21%, and is very dependent on both absolute price and the relative price movements from year to year.
- Recycling rates have remained elevated over the past several years, coincident with high copper values.
- Average growth in recycling has been 3.1% from the early 80's, greater than overall copper demand by 0.4%.

## Copper Supply – Mine Depletion



### Grade Decline – Industry

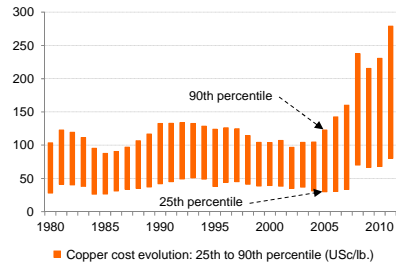


Source: Deutsche Bank, Brook Hunt

### Summary

- Structural decline in industry resource quality – periodic reversals are largely due to the introduction of new regions, as political risk perceptions change (example: Chile in the 1960s/70s)... Will Africa be the future?
- High copper prices have encouraged the exploitation of lower quality resources... this has had the impact of creating more differentiation in costs within the industry cost curve.
- We see a steeper cost curve as being more sensitive to price fluctuation.

### Cost Differentiation – On The Rise



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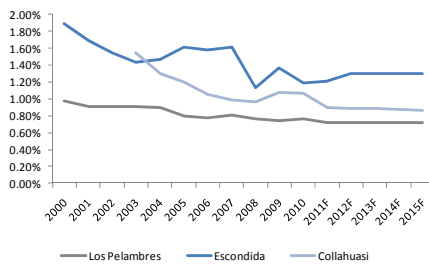
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9

## Copper Supply – Mine Depletion



### Grade Decline – Selected Mines

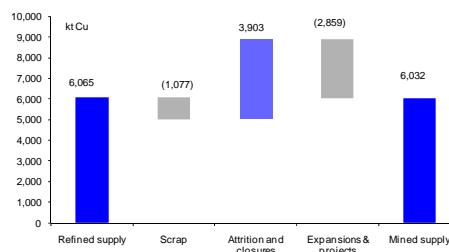


Source: Deutsche Bank

### Summary

- As mines age, the quality of the resource typically declines (at a rate which is unique to the geology of the deposit)
- New projects and expansions amount to an additional 2.9mt of copper by 2020e.
- We have also estimated 3.9mt of closed production offset to some extent by increased scrap.
- The net result is that we estimate an additional 6mtpa will be required by 2020e.

### Additional Copper Supply Requirements 2020e



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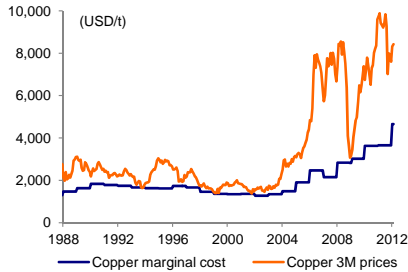
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10

## Copper Prices In Context

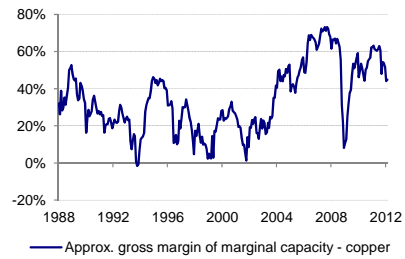


### LME Copper vs. Marginal Cost



Source: Deutsche Bank, Brook Hunt

### Est'd Gross Margin of High Cost Capacity



### Summary

- Marginal production costs tend to represent the lower boundary for copper pricing.
- Since 2005, the copper price has traded at a significant premium to marginal cost, a function of increase perceptions of scarcity with the growing demand of the emerging world, particularly China.
- We expect that marginal costs are likely to continue to climb meaningfully and thus narrow the gap between current price levels and marginal cost. This should see a regression of margins for high-cost producers to pre-2004 levels in our view.

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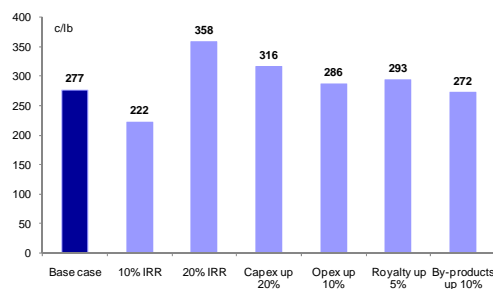
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11

## Copper – Long-term Price Assumption



### Copper Incentive Pricing – Scenario Analysis



Source: Deutsche Bank

### Outlook

- The copper incentive price is most sensitive to return expectations by the mining companies.
- Capex is the next key driver of project economics.
- Our analysis suggests that a long-term price assumption of USD2.77/lb. is appropriate.

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12



Thank-you!



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