Copper market outlook: Transitioning to deficits

Prepared for:
Nonferrous Metals Forum of the Shanghai Derivatives Market Forum, 25th May 2017

Prepared by:
Erik Heimlich,
Senior Consultant, Copper
Price has recovered from the lows and concentrates market is tightening

LME copper price recovers from the lows

Production losses were sizeable in Q1

<table>
<thead>
<tr>
<th>Mine output losses, ‘000t</th>
<th>Q1 2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Escondida</td>
<td>164</td>
</tr>
<tr>
<td>Grasberg</td>
<td>117</td>
</tr>
<tr>
<td>Total</td>
<td>281</td>
</tr>
</tbody>
</table>

Global mine output to fall due to disruptions

Spot TC’s (Chinese smelter) drop sharply

Data: CRU, LME
Refined market is insulated by scrap and stocks for the time being

**Cathode stocks are high**
- LME
- Comex
- SHFE
- Chinese Bonded

**Scrap availability has surged**
Direct use scrap, % growth

**Blister stocks have increased**
Change in Cu production by smelters & refineries, '000t

**Refined market cushioned by stocks**
Global S/D balance for concs and refined Cu, 2017, 000t

Data: CRU, LME, Comex, SHFE
Nevertheless Cu will be one of the best performing metals in 2017

Expected performance of selection of metals in 2017 vs 2016

<table>
<thead>
<tr>
<th>Price supportive factors</th>
<th>Met Coal</th>
<th>Nickel</th>
<th>Iron Ore</th>
<th>Zinc</th>
<th>Aluminium</th>
<th>Copper</th>
<th>Cobalt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stronger demand</td>
<td>-1.0%</td>
<td>3.1%</td>
<td>0.0%</td>
<td>2.3%</td>
<td>5.2%</td>
<td>1.8%</td>
<td>5.2%</td>
</tr>
<tr>
<td>Limited new supply</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>✓</td>
<td>X</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>No production cuts(1) are required</td>
<td>X</td>
<td>X</td>
<td>X (not in H1)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Market forecast in deficit</td>
<td>X</td>
<td>✓</td>
<td>X</td>
<td>✓</td>
<td>X</td>
<td>X</td>
<td>✓</td>
</tr>
<tr>
<td>Stocks critically low</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>✓</td>
<td>(Concs)</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Mine costs rising</td>
<td>Up (temp)</td>
<td>Up 5%</td>
<td>Up 5%</td>
<td>Up 2%</td>
<td>Up 8%</td>
<td>Up 1%</td>
<td>-</td>
</tr>
<tr>
<td>CRU price outlook(2)</td>
<td>Down 50%</td>
<td>Down 9%</td>
<td>Down 9%</td>
<td>Up 7%</td>
<td>Up 10%</td>
<td>Up 11%</td>
<td>Up 58%</td>
</tr>
</tbody>
</table>

Data: CRU  Notes: (1) Over and above those announced. (2) Average price in 2017 versus Q4-2016
Structural deficits are imminent for the copper market

- Existing mine production to decline by 1% p.a. in years to 2025, due to declining ore grades and reserve exhaustion

- The downturn has led to project delays, downsizing and cancellations of projects and expansions

- Scrap availability to grow more strongly in higher price environment but will not fully compensate for the slow growth in mine supply

- There are limits to the speed at which producers can bring new mine supply on-stream quickly

- As long as global demand continues to expand at close to 2.0% p.a., structural deficits in this market appear inevitable
Demand growth expected to remain robust despite slowdown

Global growth in refined copper consumption by decade, ‘000t

Global growth was ~2m tonnes in each 10-year period

Commodity boom saw demand growth rise to ~4.7-5.1m tonnes every 10 years

Despite China slowdown, volume growth will remain robust

Data: CRU

www.crugroup.com
China will represent less than 40% of growth in demand in 2016-21

Growth in world refined copper consumption and volume growth in selected 5-year periods

**Growth in global refined copper demand, %**

- 2015: 1.2%
- 2016: 2.5%
- 2017: 1.8%
- 2018: 2.2%
- 2019: 2.1%
- 2020: 1.8%
- 2021: 1.8%

CAGR 2016-2021: 1.9% p.a.

**Absolute consumption growth in period, Mt**

- **China**
  - 2006-11: -1.8 Mt
  - 2011-16: 0.5 Mt
  - 2016-21: 1.0 Mt

- **Rest of World**
  - 2006-11: 0.0 Mt
  - 2011-16: 3.8 Mt
  - 2016-21: 2.8 Mt

Data: CRU

www.crugroup.com
Other parts of global economy expected to offset Chinese slowdown

**Vehicle production, CAGR % p.a.**

- China: CAGR 2010-2016, CAGR 2017-2021
- Asia ex-China: CAGR 2010-2016, CAGR 2017-2021
- Europe: CAGR 2010-2016, CAGR 2017-2021
- North America: CAGR 2010-2016, CAGR 2017-2021
- Other: CAGR 2010-2016, CAGR 2017-2021
- World: CAGR 2010-2016, CAGR 2017-2021

**Investment, as % GDP**

- World
- China, RHS

**Growth in construction output*, y-o-y%**

- China
- Developed economies
- World

*Weighted by gross value added in construction, 2010 prices and market exchange rates

**Industrial production, CAGR % p.a.**

- China: CAGR 2010-2016, CAGR 2017-2021
- Asia ex-China: CAGR 2010-2016, CAGR 2017-2021
- Europe: CAGR 2010-2016, CAGR 2017-2021
- North America: CAGR 2010-2016, CAGR 2017-2021
- Other: CAGR 2010-2016, CAGR 2017-2021
- World: CAGR 2010-2016, CAGR 2017-2021

Data: CRU, Oxford Economics, LMC Automotive
India and ASEAN will see fastest growth in copper demand

Refined copper consumption growth and compound annual growth in selected periods, % p.a.
Supply: Investment in the copper industry is highly pro-cyclical

Selected projects* investment plans**, ‘000t

LME 3-month copper price, real (2016$)

Note: *35 projects with an average nominal capacity of 185,000t **based on nominal capacity and measured from date of first approval to first commercial production

Data: CRU
Pipeline of mine projects is very thin: no large projects starting up in 2017

Copper mine projects with capacity of >100,000t/y; LOM annual copper production capacity; ’000t

Data: CRU
Our estimates suggest growth in mine output will be <1Mt in 2016-21

Growth in global mine production, copper-in-concentrates and EW cathode, ‘000t Cu

Dramatic increase in mine production following heavy phase of investment

Growth slows sharply due to lack of new projects, declining ore grades and reserve exhaustion

Data: CRU
Causing structural deficits and copper prices to recover

Copper LME cash price and global supply/demand balance, 2015-2021

Data: CRU

www.crugroup.com
Next phase of investment should begin as long as prices hold up

Real (2016$) full economic costs for all projects due to start-up between 2017-2028, $/t
In the meantime, prices set to rise faster than costs: Margins to improve

LME cash price and 75th percentile net of by-product cash costs, $/t, 1983-2021

Data: CRU, LME
Copper prices recovered sharply at end-2016 and were buoyed in early-2017 by sizeable disruptions to mine output.

While the concentrates market has tightened, the refined market will be the last to pick-up in the cycle, due to the existence of stocks.

However, destocking along the supply chain is already underway, which gives us cause for optimism.

The increase in copper prices in 2017 is expected to be amongst the highest of the major metals.

Following the downturn, the pipeline of major projects is extremely thin.

Assuming we continue to see global growth in demand of around 2% p.a., the copper market will move into structural deficit.

Producer margins are expected to improve to around $3,200/t by 2021 for the mine at the 75th percentile of the cost curve; an increase of 150% compared to 2016.
Where does KGHM place on the cost curve?
Net of by-product cash costs, selected producers, $/lb (LHS) / $/T (RHS)