Copper market outlook: Transitioning to deficits

Prepared for:
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Director of Copper Research & Strategy
**Structure of Presentation**

1. **Current Copper Market**: Deficits delayed but still expected
2. **Demand Outlook**: Period of transition as China slows
3. **Supply Outlook**: Still in need of more supply
4. **Investment Cycle**: Have we moved to the upside of the cycle?
Price has recovered from the lows but next step-up remains elusive

**New range established for the LME price**

<table>
<thead>
<tr>
<th>LME 3-M, $/tonne</th>
</tr>
</thead>
<tbody>
<tr>
<td>4,000</td>
</tr>
<tr>
<td>4,500</td>
</tr>
<tr>
<td>5,000</td>
</tr>
<tr>
<td>5,500</td>
</tr>
<tr>
<td>6,000</td>
</tr>
<tr>
<td>6,500</td>
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</tbody>
</table>

**Production losses were sizeable in H1**

<table>
<thead>
<tr>
<th>Mine output losses*, '000t</th>
<th>H1 2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Escondida</td>
<td>233</td>
</tr>
<tr>
<td>Grasberg</td>
<td>253</td>
</tr>
<tr>
<td>Other</td>
<td>66</td>
</tr>
<tr>
<td>Total</td>
<td>552</td>
</tr>
</tbody>
</table>

*Estimated

**Spot TC’s pick-up unexpectedly**

<table>
<thead>
<tr>
<th>Spot TC’s (Chinese smelter), $/t</th>
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<tbody>
<tr>
<td>60</td>
</tr>
<tr>
<td>70</td>
</tr>
<tr>
<td>80</td>
</tr>
<tr>
<td>90</td>
</tr>
<tr>
<td>100</td>
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<tr>
<td>110</td>
</tr>
<tr>
<td>120</td>
</tr>
<tr>
<td>130</td>
</tr>
<tr>
<td>140</td>
</tr>
</tbody>
</table>

**Cathode premiums remain depressed**

[CIF Rotterdam (LHS), China imported (LHS), US East Coast (RHS)]

Data: CRU, LME
Refined copper market insulated by scrap and stocks

Scrap availability has surged this year…

Global growth in direct use scrap, %

-2% 1.4% 0.5% -1.0% 6.3%
2012 2013 2014 2015 2016 2017

...depressing global refined copper demand

Cu consumption growth, 2017, %

-1% 0% 1% 2% 3% 4%
-1% 0% 1% 2% 3% 4%
World China Eur/Am/Asia* Other

Blister stocks were high at start of 2017

Change in Cu production by smelters & refineries, '000t

1500 1000 500 0
2014 2015 2016

Cathode stocks are still sizeable despite recent drawdown

Change in Cu production by smelters & refineries, '000t

2000 1500 1000 500 0
01 12 01 13 01 14 01 15 01 16 01 17

Data: CRU, LME, Comex, SHFE

*Western Europe, North America and North East Asia
Medium term market deficits remain intact

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

Data: CRU
Structure of Presentation

1. Current Copper Market: *Deficits delayed but still expected*
2. Demand Outlook: *Period of transition as China slows*
3. Supply Outlook: *Still in need of more supply*
4. Investment Cycle: *Have we moved to the upside of the cycle?*
Global demand per capita still increasing steadily with GDP per capita

S-curve for global refined copper demand, 1980-2016

- The S-curve for copper continues to grow at a steady pace.
- By 2016, global refined copper consumption had reached 3kg/capita.
- Over the years 1980-2016, a $1M increase in GDP/capita, led to a 0.22kg/capita increase in refined copper consumption globally.
- Can we expect this pace of growth to continue?

Data: CRU
There appears to be plenty of potential for further demand growth…

S-curve for refined copper demand by country, 2017

Data: CRU
…but China is set to slow which influences the global outlook

### Global refined copper demand per capita, 1980-2026

**Cu consumption, kg/capita**

- **Demand per capita levels off after 2021 reflecting developments in China**

### China refined copper demand per capita, 1980-2026

**Cu consumption, kg/capita**

- **Phase of heavy industrialisation ends**

### Developed world refined copper demand per capita, 1980-2026

**Cu consumption, kg/capita**

- **Some support from developed world**

### Developing world refined copper demand per capita, 1980-2026

**Cu consumption, kg/capita**

- **Per capita consumption growth picks up but from low base**

*Note: Excludes Russia and China*
Demand growth will increasingly be driven by world ex-China

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

Growth in global refined copper demand, %

Absolute consumption growth in period, Mt

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

Growth in global mine production including EW, ‘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
Pipeline of large mine projects is thin: No new projects starting up in 2017

Copper mine projects with capacity of >100,000t/y; LOM annual copper production capacity; ’000t
There are more smaller-sized projects being developed but it is still not enough

Projects and expansions due on-stream in 2017-21, with capacity of >50kt and <100kt, '000t of contained Cu
Codelco’s mine production static in next 10 years

Output from Codelco mines*, committed and uncommitted, ‘000tpy Cu; Mine project details to 2025

<table>
<thead>
<tr>
<th>Project</th>
<th>Capacity, ‘000t/y</th>
<th>Estimated Start Date</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chuquí’mata Ripios</td>
<td>35</td>
<td>Q2 2017</td>
<td>Firm</td>
</tr>
<tr>
<td>RT SBL (bio-leach)</td>
<td>30</td>
<td>Q3 2018</td>
<td>Probable</td>
</tr>
<tr>
<td>Chuquí’mata Underground</td>
<td>320</td>
<td>Q1 2020</td>
<td>Firm</td>
</tr>
<tr>
<td>Salvador Extension (Rajo Inca)</td>
<td>50</td>
<td>Q3 2022</td>
<td>Possible</td>
</tr>
<tr>
<td>El Teniente</td>
<td>430</td>
<td>Q3 2023</td>
<td>Firm</td>
</tr>
<tr>
<td>RT Sulphides</td>
<td>150</td>
<td>Q3 2024</td>
<td>Possible</td>
</tr>
<tr>
<td>Andina Expansion II</td>
<td>120</td>
<td>Q3 2025</td>
<td>Possible</td>
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*Note: Production quoted before disruption allowances

Data: CRU
We are cautious on Grasberg but there could be upside potential

Grasberg output ‘000t Cu: Current vs. previous forecast (LHS); Annual average production (RHS)

- **2014 Disruption**: Dispute over progressive export tax on concentrates
- **2017 Disruption**: Dispute over replacement of Contract of Work (CoW) by Special Mining Licence
- **2015 Disruption and Delay**: Labour dispute and DMLZ expansion project delays
- **2019 Transition**: End of OP and treatment of low grade stockpiles
- **2022-25 Grades**: Planned decline in Cu ore grade at bloc cave

Data: CRU
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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
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
Have we moved onto the upside of the cycle?

- Copper prices have maintained the trading range established at the start of the year but have not found the impetus to move higher.

- A combination of stocks of concentrate, blister, cathode and scrap have insulated the refined copper market in 2017.

- Modest sized global surpluses are forecast for 2017 and 2018, before structural deficits emerge in 2020 on the back of limited supply growth.

- Following the market downturn of recent years, the pipeline of major copper projects is extremely thin. Many new projects will be needed by the mid-2020s.

- Global demand growth is expected to slow in the years 2016-26, as China’s heavy industrialisation phase comes to an end.

- There is no new China about to take-off in the short term but global demand growth is nevertheless anticipated.

- Producer margins are expected to improve to a level of $3,123/t by 2021 for the mine at the 75th percentile of the cost curve; an increase of 154% compared to 2016.
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- Copper Market Outlook
- Copper Long Term Market Outlook
- Copper Mine Project Profiles
- Copper Raw Materials Monitor
- Copper Concentrates Market Outlook
- Copper Studies
- Copper Semis Market Outlook

COST SERVICES
- Nickel Chrome Molybdenum Monitor
- Nickel Market Outlook
- Molybdenum Market Outlook
- Cobalt Market Outlook
- Lead Monitor
- Lead Market Outlook
- Lead and Zinc Concentrates Monitor
- Zinc Monitor
- Zinc Market Outlook

CONSULTING CAPABILITY
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