



# Copper Demand Outlook

For the Resolution Community Working Group of Rio Tinto

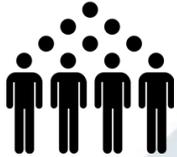
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- The purpose of this presentation is to provide an educated view on likely future scenarios, which need to be further explored by the users of the information provided.

## Market drivers are forecasted to have a positive impact on copper demand



### Population growth

The global population is expected to reach 8.3 billion by 2026. This is **1% p.a. growth** 2020-2026.\*

- The growing population will purchase additional goods and services using copper.
- The population is also striving to become more wealthy purchasing even more goods and services.

\* worldometer



### GDP/ Industrial production

Global GDP is expected to strongly recover in 2021 and 2022. IMF also forecasts an average GDP growth 2020 - 2026 of 6.4% p.a. \*\*

- 6.4% p.a. forecasted GDP growth is significantly higher than 2.2% p.a. average GDP growth rate 2013-2018. \*\*
- The majority of products produced as part of the fast-growing GDP will need copper for electrical and non-electrical components.

\*\* IMF



### Fiscal & monetary stimulus

Post Covid, many major governments led an expansionary monetary and fiscal policy to maintain demand.

- Many of these policies focussed on copper intensive long-due upgrades of infrastructure, housing and the general revival of the economy.
- Infrastructure projects oft last longer and create copper demand well after 2021.



### Green transition

The expansionary fiscal policy included an increased focus on green transition and actions to meet carbon emission reduction targets.

These targets can only be achieved if

- thermo electricity generation is replaced by renewable generation,
- ICE vehicles are replaced by electric (or hydrogen) vehicles, and
- smart systems optimize energy consumption.

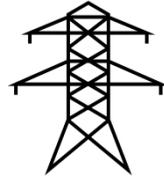
## Green transition offers significant growth potential for copper demand



### Renewable energy

Renewable energy generation uses significantly more copper than thermo and nuclear.

- PV Solar
- Wind
- Grid connection
- Energy storage



### Electrification and infrastructure expansions

Electrification, the use of more electric appliances and systems, expanding electrical infrastructure significantly increases copper demand in the future.

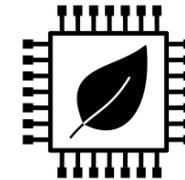
- Reliable electrical transmission and distribution systems
- Upgrade of electricity infrastructure for reliance
- Energy storage for peak consumption
- Local grids



### Electrical mobility and charging infrastructure

Electrical mobility is a key aspect of green transition and requires significantly more copper than the currently used ICEs.

- High performance electrical motors and batteries in electrical vehicles (EVs) and other electrical transport
- Local EV charging infrastructures
- Fast charging points

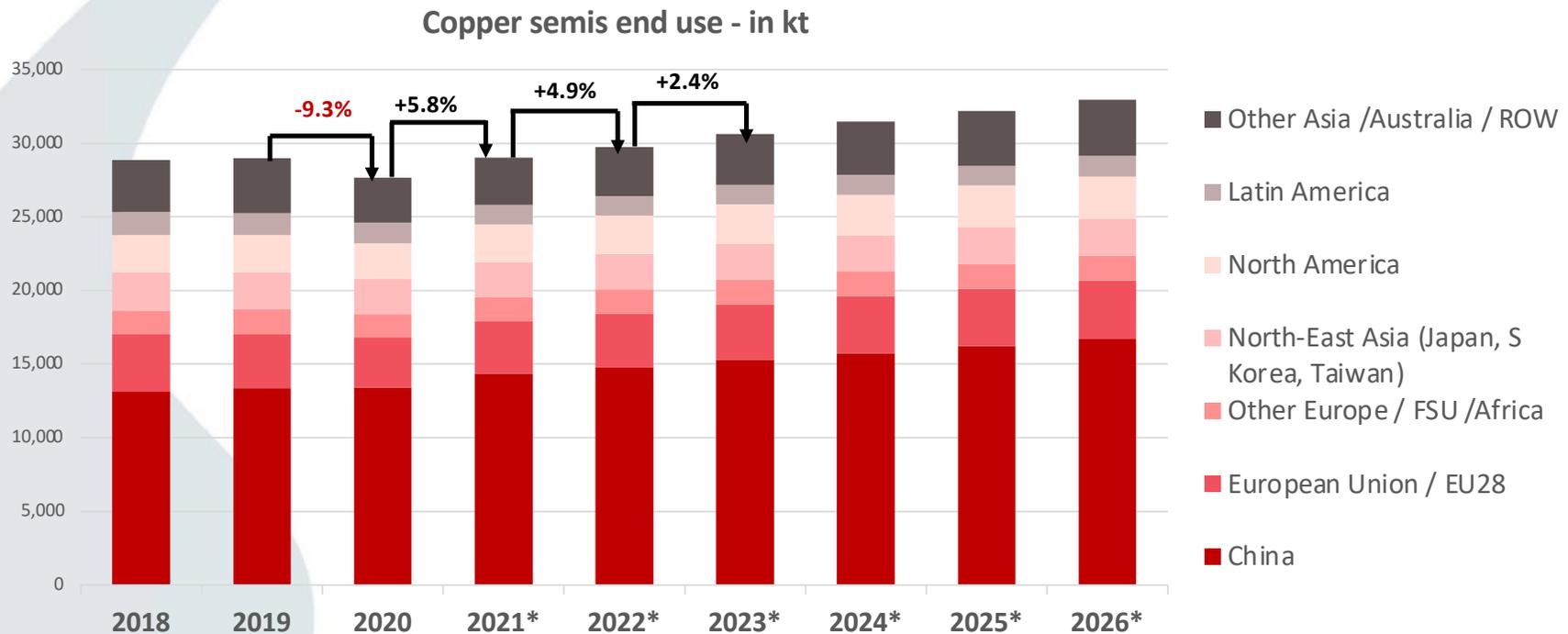


### Smart solutions

Smart solutions include a wide range of systems involving an increased use of electrical, signal connections and computer integrated systems using copper.

- Smart systems to reduce electricity consumption and to optimize electricity use
- Smart manufacturing employing robots
- Other components such as copper heat exchange, precision casting alloys

**Global copper semis end use is expected to strongly grow in 2021/2022 driven by the fiscal & monetary stimulus and green transition. After 2023 the key driver is expected to be green transition.**



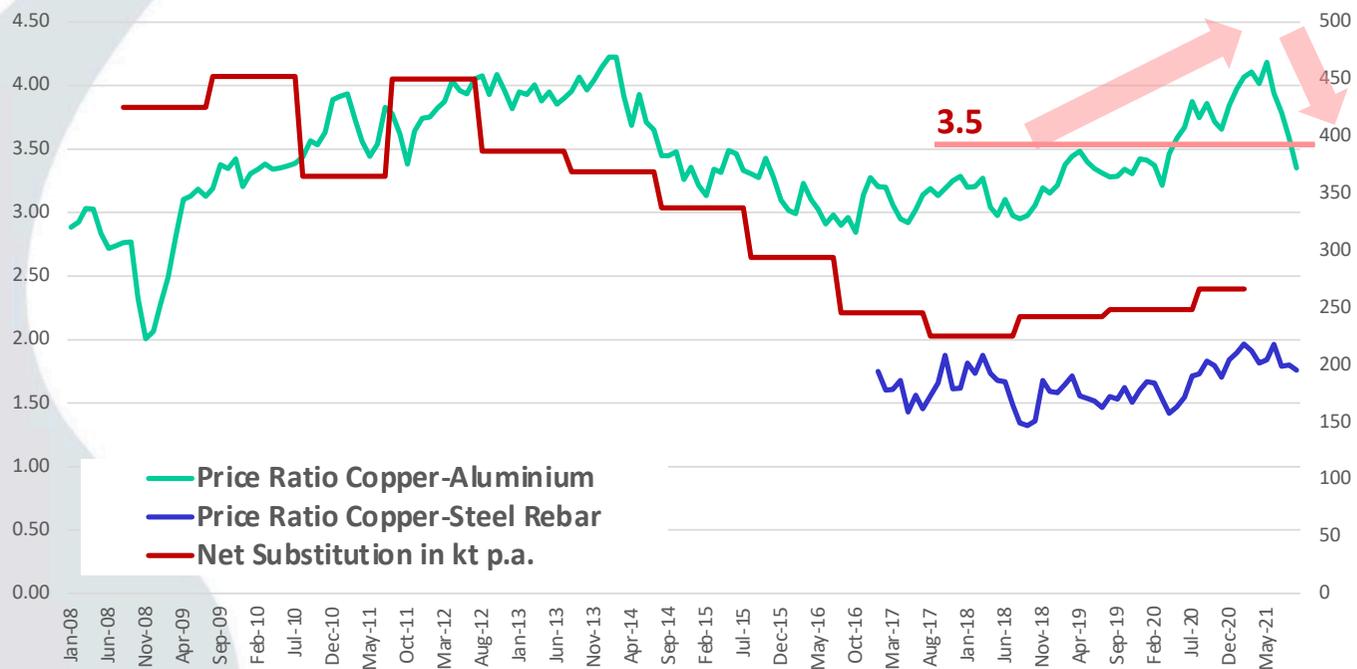
\* forecast

## Will material substitution balance demand?

- **Increasing and volatile raw material prices create significant issues for OEMs, appliance manufacturers and other copper end users**
- **Substitution trends**
  - Copper is used in different applications for a good reason, as it is the best material for the purpose. Any material substitution needs to offer significant and long-term advantages to justify investment into new design and production technology using alternative materials.
  - If it occurs, copper material substitution often happens where alternative materials bring significant cost reduction of the total project costs without compromising performance and quality.
  - Substitution can also happen where alternative materials bring further benefits, in addition to the lower material costs, e.g., lighter weight or reduced cost of installation.
- **Extent of substitution in 2020/21**
  - 2020 was characterised by stable substitution with **net substitution at 0.95% of copper use** on the back of relatively low copper material costs in H1/2020. Yet, copper material costs have increased in H2/2020 setting the foundation for higher substitution in 2021.
  - Costs of alternative materials like aluminium and steel also increased in 2021 and copper became relatively good value. The key substitution driver, the copper-aluminium price ratio has fallen below the substitution motivations threshold of 3.5 in September 2021 indicating an expected slower substitution in 2H/2021 and 2022.

## Recently, the copper-aluminium price ratio, a key substitution indicator, dropped below 3.5

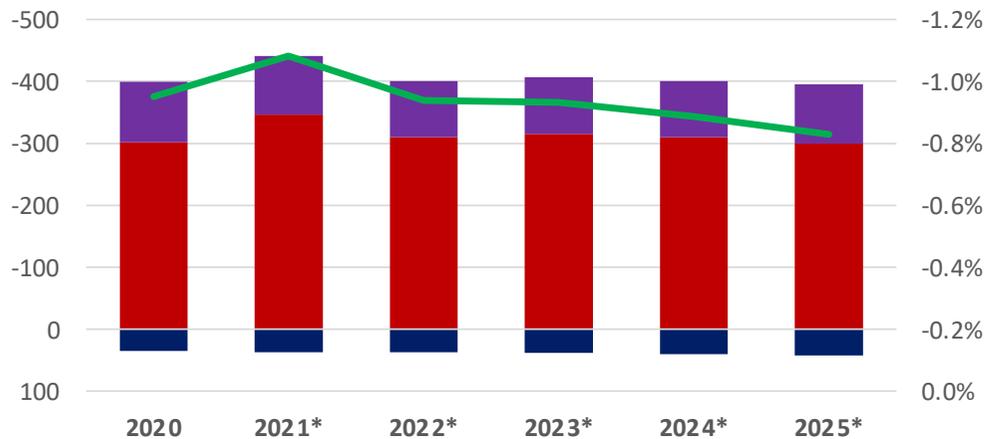
Price Ratios (Cu-Al, Cu-Steel Rebar) and Net Substitution - in kt



Prices used: Monthly average LME Copper and Aluminium Cash-Settlement Price, Price of Steel Rebar according to Trading Economics

## Substitution is expected to accelerate in H12021 but slow thereafter as costs of alternative materials have significantly risen and green transition supports applications with limited exposure to substitution

Copper Substitution and Miniaturization  
- in kt and % of Copper Use in 2020-2025



\* Forecast

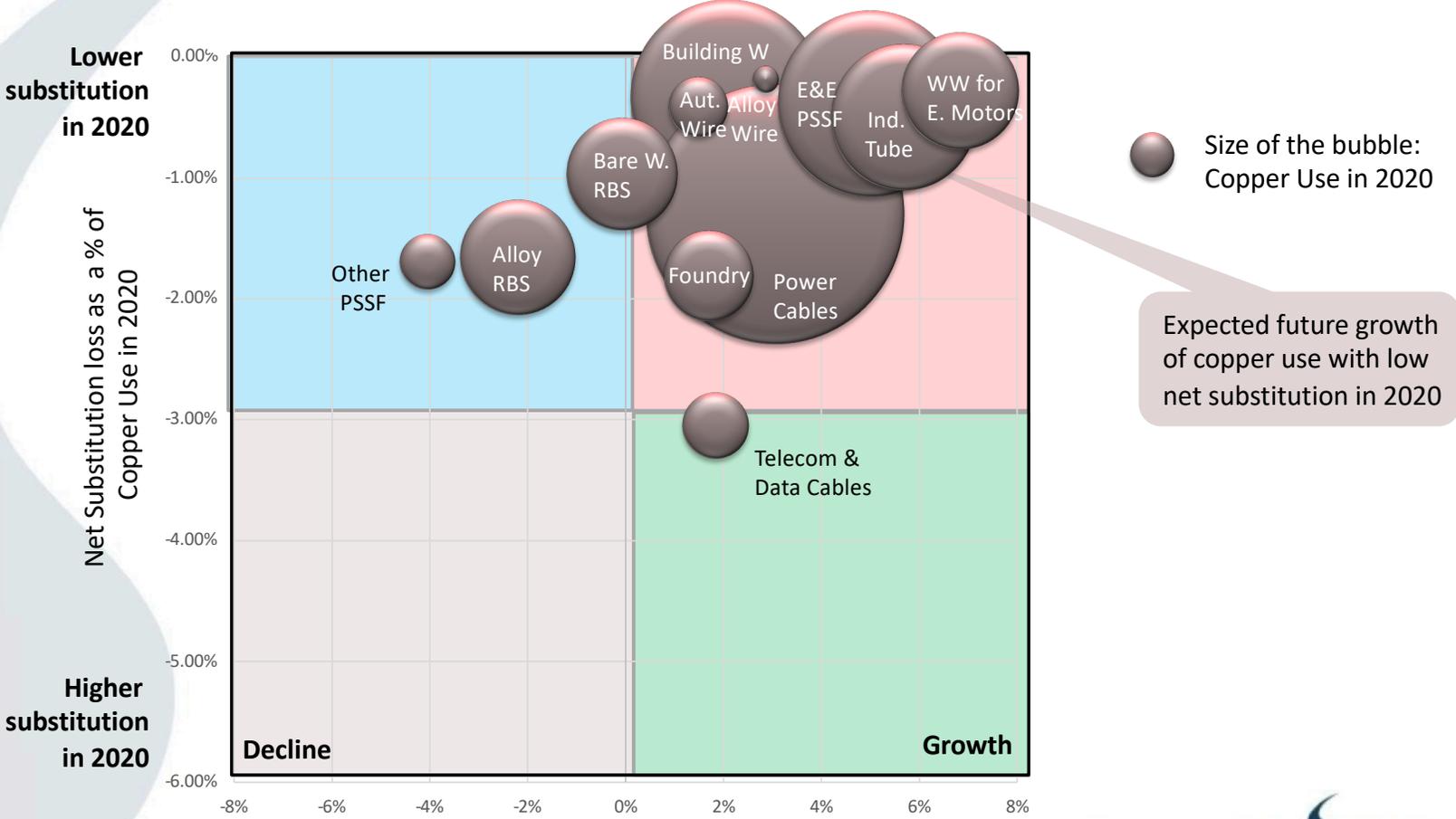
- Substitution
- Substitution Gain
- Miniaturization
- Net Substitution as % of Copper Use

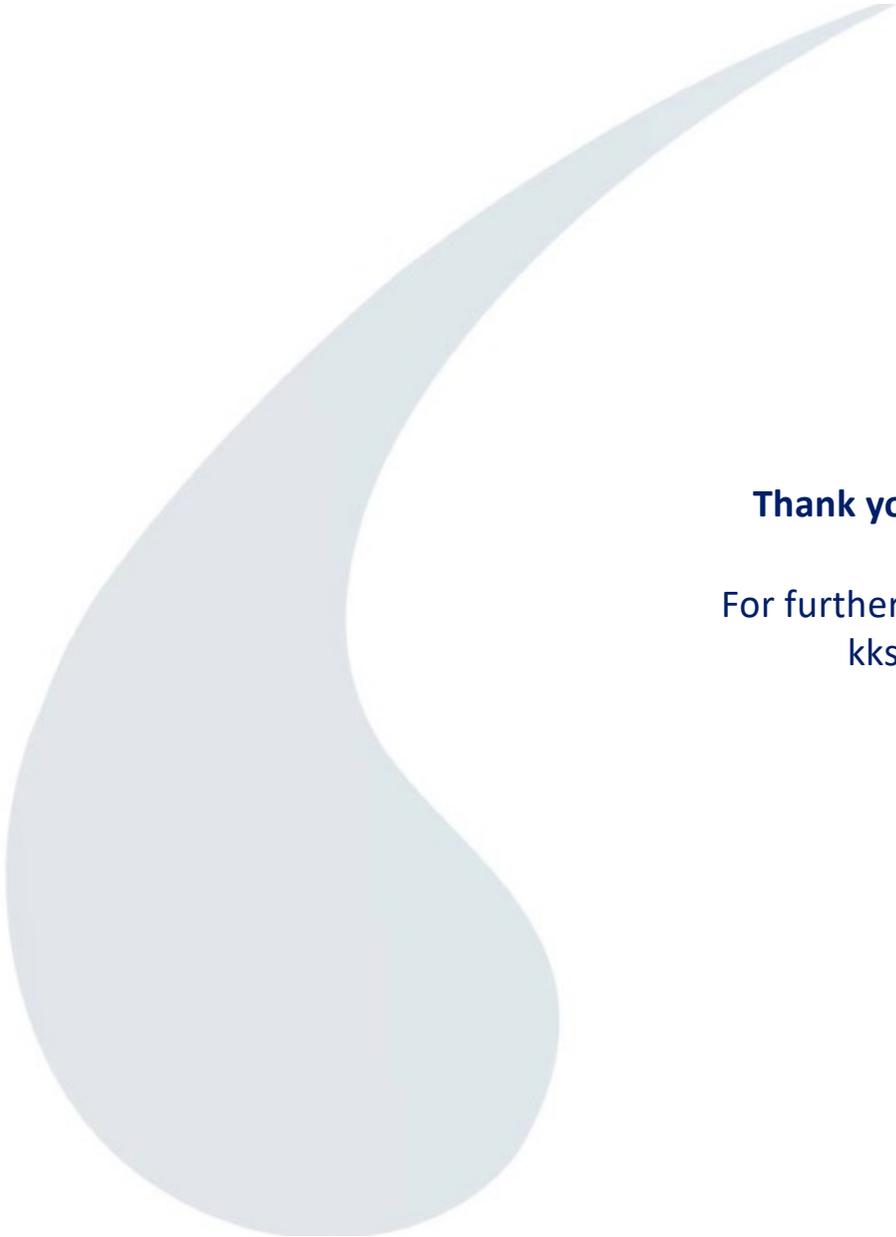
### Substitution

- In 2021 we expect accelerating substitution for applications - where feasible.
- At the same time, in 2021 aluminium and steel prices have risen to historic heights, making copper relatively good value.
- A year of high copper material costs in the past will have initiated some irreversible substitution and further R&D into the use of alternative materials.
- From 2023, copper substitution is expected to slow.

# Copper products with the largest markets experienced low net substitution in 2020, and expected to grow their markets over the next five years

Expected future annual growth of copper use (CAGR 2020-25) in %





**Thank you very much for your attention.**

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