

Miniaturization and Minimization and How they Affect Copper Demand

Research Conducted by: CRU Group

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Miniaturization and Minimization (M&M), as they relate to copper demand, cover a broad spectrum of end-use markets from automotive to consumer electronics and wiring. The International Copper Association commissioned a study by CRU to assess and determine the level of impact M&M will have on the future of copper demand.

Definitions:

Miniaturization: Performing the same function with a smaller product. (The evolution of the cell phone from its origins to its current pocket-size exemplifies this.)

Minimization: Performing the same function with less material.

KEY FINDINGS

- The CRU research found that the net impact of M&M is neutral.
- There is little evidence to suggest that M&M constitute a significant trend affecting wire and cable applications.
 - Copper accounted for the majority of the conductor content of electrical applications and wire and cable in 2015 at 82%.
- Miniaturization is a key driver of innovation in consumer electronics, which has led to new sources of copper demand:
 - Miniaturization is vital to increasing computing power by enabling a greater number of transistors to be placed on an integrated circuit board.
 - As transistors got smaller, wires had to become thinner, making aluminum problematic. Aluminum was substituted out and replaced by copper around 1997.
 - As this miniaturization evolves, it has led to new electronic devices such as desktop computers, laptops, smartphones and tablets, all of which contain copper.
- Developments in wiring technology have partly facilitated the commercialization of electric vehicles and can be linked to M&M.
 - Electric vehicles contain roughly two to four times more copper than conventional internal combustion engines.

As part of its methodology for the report, CRU established a grading metric to gauge the impact of M&M on copper use: 1 being negative, 3 neutral, and 5 positive.

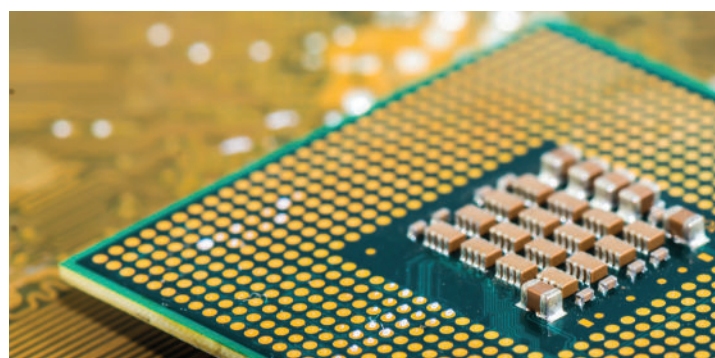
One area of analysis focused on five core industries which comprised the majority of global copper demand from 2015. Those areas were Infrastructure, Equipment, Transport, Construction, and Industrial.

The following table demonstrates that the net impact of M&M is neutral.

	Global copper demand 2015	Net Impact Score
Infrastructure	35%	3.0
Equipment	19%	3.0
Transport	13%	4.0
Construction	8%	2.5
Industrial	6%	3.0
Total*	100%	3.1

* Weighted average

1 is negative, 3 is neutral and 5 is positive.



For additional information about copper or the International Copper Association please visit www.copperalliance.org or www.sustainablecopper.org.

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