

## Indian Copper Industry- Trends and Outlook

**Contact:**

**Madan Sabnavis**  
Chief Economist  
madan.sabnavis@careratings.com  
+91-22- 6837 4433

**Author:**

**Urvisha Jagasheth**  
Research Analyst  
urvisha.jagasheth@careratings.com  
+91-22- 6837 4410

**Mradul Mishra (Media Contact)**  
mradul.mishra@careratings.com  
+91-22-6837 4424

In this report we will be discussing the dynamics of the Indian copper industry, its trend (demand-supply, trade, pricing) in the past 5 years, the situation in the current financial year (2019-2020) and outlook (page 11) for the same. We will also be covering the demand-supply of the red metal in the international markets.

### Overview

Copper is an important non-ferrous base metal having wide industrial applications. Today it has become the 3<sup>rd</sup> most used industrial metal after steel and aluminium in terms of quantities consumed.

As compared with the global markets, India has limited copper ore reserves which constitute around 2% of the world copper reserves and mining production too is just 0.2% of the world's production.

There are three major players which dominate the primary copper industry in the Indian Markets. Hindustan Copper Limited (HCL) in Public Sector, Hindalco Limited and Vedanta Industries Limited in Private Sector.

### Structure of the Copper Industry

The copper industry can be classified into four categories

**Chart 1: Industry Segmentation**



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## Domestic Copper Industry

India has limited copper mines which are mainly concentrated in the states of Rajasthan, Madhya Pradesh, Bihar and Jharkhand. The largest resources of copper ore are in the state of Rajasthan. Hindustan Copper holds all the operating copper mining leases in India, making it the sole copper miner in the country.

Copper companies usually buy the copper ore from the overseas markets or they will import it from the mines they have ownership in foreign countries. These companies have set up their smelting and refining plants in India, which refines the copper concentrates to convert it to pure metal also known as copper cathodes.

## Production Capacity

**Table 1: Domestic copper cathode smelting capacity (in terms of Kilo Tonnes (KT))**

Company	Location	Smelting and Refining Capacity
Hindalco	Dahej	500
Vedanta	Tuticorin*	400
Hindustan Copper	Various Locations**	99.5***

Source: Company Filings, CARE Ratings

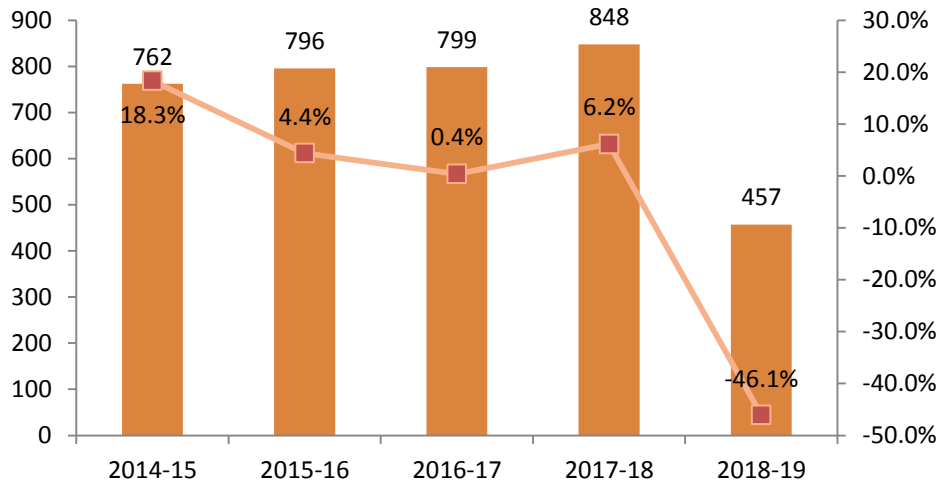
Note: One must keep in mind that capacity data only reflects production capabilities \*not operational since March, 2018 \*\*Hindustan Copper Limited (HCL) is a vertically integrated company. The mines owned by HCL have the Smelting facilities located right next to their mines (Khetri Copper Complex which is in Rajasthan and Indian Copper Complex which is located in Jharkand). Gujarat Copper Project (formerly known as Jhagadia Copper Limited, acquired by HCL), is into smelting and refining of secondary copper \*\*\*Although the installed capacity of cathode is shown as 99.5 KT (KCC - 31 KT & ICC – 18.5 KT, GCP – 50 MT), due to economic consideration the Company suspended KCC smelter & refinery from December 2008. Hence the current available capacity is 68.5 KT.

**Total capacity available for copper cathode smelting in India for the current year i.e. FY20 is 568.5 KT.**

## Production

Primary refined copper production is referred to as ‘refined copper derived post smelting the mined copper ore and concentrates’. Secondary refined copper production is when we derive refined copper through the same processes used for the production of primary copper but the raw material used is copper scrap. Copper is among the few materials that do not degrade or lose their chemical or physical properties in the recycling process. Copper scrap derives from either metals discarded in semis fabrication or finished product manufacturing processes (“new scrap”) or obsolete end-of-life products (“old scrap”).

**Chart 2: Domestic Refined Copper Production (units in KT)**

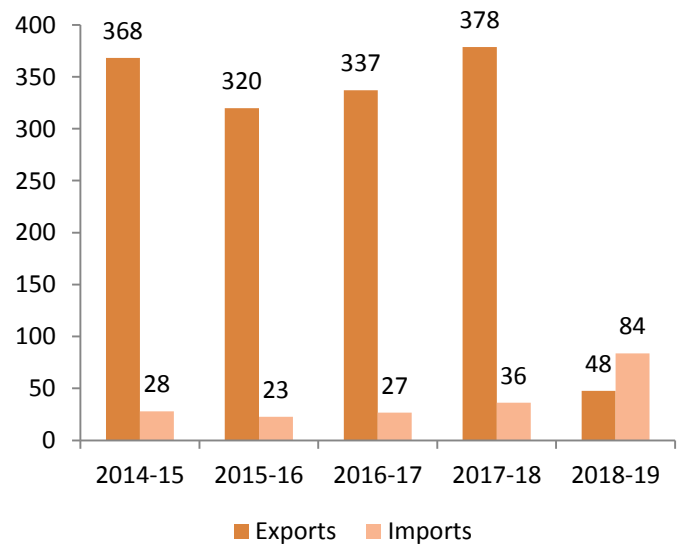
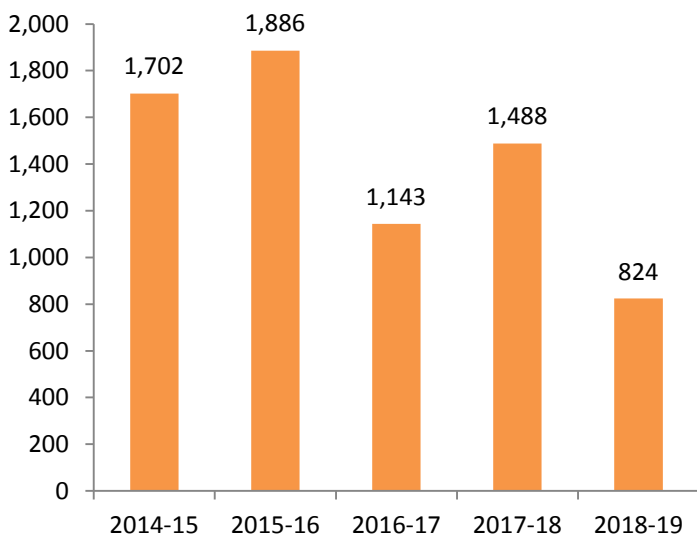


Source: Ministry of Mines, CARE Ratings

Domestic production of refined copper had grown at a CAGR of 9.6% during FY14-18. Production fell by 46.1% during FY19 due to the permanent closure of Sterlite’s 400KT copper factory in Thoothukudi (formerly known as Tuticorin) on 28 May 2018. The Tuticorin smelter accounts for 40% of the country’s copper smelting capacity. Refined copper production had also fallen during FY19 as output from Hindustan Copper and Hindalco was also low due the planned shutdown of its smelters during the first half of the year.

**Trade**

**Chart 3: Imports of Copper Ores and Concentrates (units in KT) Chart 4: Exports and Imports of Copper Cathodes (units in KT)**



Source: Ministry of Commerce

India has emerged as an importer of copper ore and concentrates and imports more than 90% of our concentrate requirements due to the lack of copper mines present in the country. Imports of copper ore and concentrates fell by 44.6% during FY19 due to the lack of requirement from the Tuticorin smelter.

India used to be a net exporter of copper cathodes till FY18. Now with the closure of the Tuticorin smelter, the drop in domestic production has led to the domino effect of increasing the country's imports and decreasing its exports. India has become a net importer of refined copper after 18 years.

During FY19, exports had fallen by 87.4%, (during FY18 exports had increased by 12.3%) whereas imports increased by 131.2% (during FY18 imports had increased by 35.6%).

India imported refined copper from, Japan (71%), Congo (6%), Singapore (5%), Chile (4%), Tanzania (4%), UAE (4%) and South Africa (3%) and exported refined copper to China (75%), Taiwan (13%), Malaysia (5%), South Korea (5%) and Bangladesh (2%) during FY19. Share of exports towards China has increased, from it being 63% during FY18 to 75% during FY19 and share of imports from Japan has increased from it being 68% during FY18 to 71% during FY19.

### Application/Usage of Copper

Copper is a malleable, ductile metallic element and an excellent conductor of heat and electricity. Copper also has relatively high creep strength as compared to other commonly used materials.

**Electrical/Electronic Industry** is the largest consumer of copper, where it is used in the form of cables and winding wires as it encounters much less resistance and is safe for electrical distribution system from high voltage transmission cables to micro-circuits. Copper is also used in power cables, either insulated or uninsulated, for high, medium and low voltage applications. Copper is an essential component of energy efficient generators, motors, transformers and renewable energy production systems. Renewable energy sources such as solar, wind, geothermal, fuel cells and other technologies are all heavily reliant on copper due to its excellent conductivity.

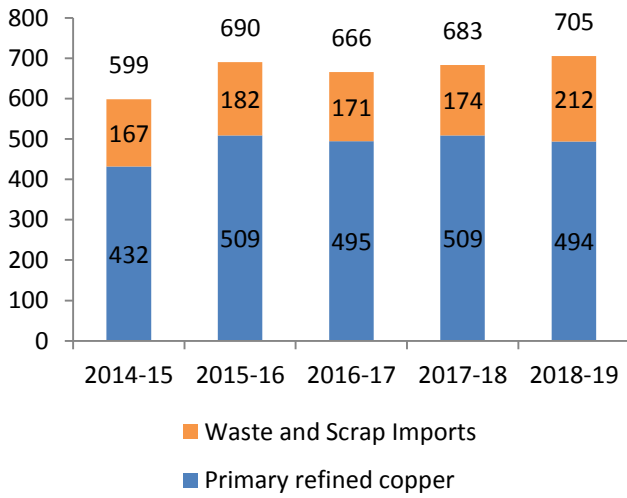
Copper plays a key role in worldwide information and **telecommunications** technologies. HDSL (High Digital Subscriber Line) and ADSL (Asymmetrical Digital Subscriber Line) technology allows for high-speed data transmission, including internet service, through the existing copper infrastructure of ordinary telephone wire. Copper and copper alloy products are used in domestic subscriber lines, wide and local area networks, mobile phones and personal computers.

**Building and construction industry**, copper is used in plumbing, taps, valves and fittings components.

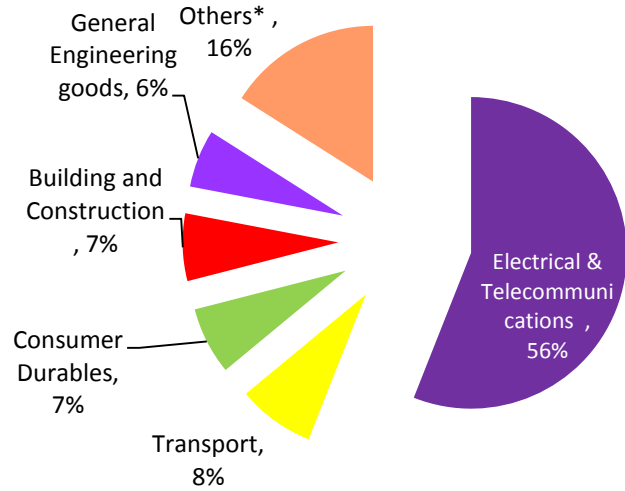
In the **transportation industry**, copper is used in various components such as copper motors, wiring, radiators, connectors, brakes and bearings. EVs are guzzlers for copper. According to an estimate by ICSG most cars contain an average of 20 kg copper and luxury & hybrid vehicles contain about 45 kg copper. Electric vehicles (EVs) contain approximately 4 times more copper than conventional cars. It is used in batteries, windings and copper rotors used in electric motors, wiring, busbars and charging infrastructure.

Copper is also used in making **industrial machinery** and **equipment**. Due to their durability, machinability and ability to be cast with high precision and tolerances, copper alloys are ideal for making products such as gears, bearings and turbine blades. Copper's superior heat transfer capabilities and ability to withstand extreme environments makes it an ideal choice for heat exchange equipment, pressure vessels and vats.

**Chart 5: Domestic Refined Copper Consumption (in units of KT) Chart 6: Sector-Wise Consumption of Copper in India**



Source: Ministry of Mines, Ministry of Commerce, CARE Ratings



Source: Ministry of Mines

Others\* also includes process industries

Consumption of refined copper (including secondary consumption) has grown at a CAGR of 4.2% during FY15-19. Need for wiring in infrastructure projects and renewable energy projects, increase in automobile production (which grew by 7.3% CAGR) and increase in production of consumer durables (production of refrigerators and air conditioners increased by 6.9% and 0.7% respectively) has augmented the consumption of copper in the last 5 years.

**Demand drivers**

**Infrastructure:** We see the demand for copper in the electrical segment to grow due to the demand via the infrastructure sector. The PMAY scheme will be the driver of consumption for copper in the building and construction sector. The PMAY-G, scheme aims to provide 1.95 crore houses till FY22 whereas PMAY-Urban aims to provide over 81 lakh houses (with an investment amount sanctioned around Rs 4.83 lakh crore).

**Automobiles Sector (E-bikes/EVs):** The government has announced a series of support measures and incentives, as a result of which electric vehicles will see a steady growth in the coming years across the country. Manufacturing of EVs uses 3 times the copper than normal automobiles.

**Power sector (Renewable energy):** The country has set an ambitious target of installing 175 GW of renewable energy capacity by the year 2022 which could augment the use of copper for wiring applications.

**Consumer Durables:** - Demand for durables like refrigerators and other consumer electronic goods are likely to witness growing demand in the coming years in the rural markets with the government being very proactive and in investing significantly towards rural electrification.

**Telecom Sector:** The increasing penetration of mobile phones in urban and rural areas will further result in more demand for telecom towers in rural areas.

## Copper Industry performance during 2019-20

Table 2: Domestic Production, Consumption, Exports and Imports of Primary Refined Copper (KT)

	Production	Change (y-o-y)	Consumption	Change (y-o-y)	Exports	Change (y-o-y)	Imports	Change (y-o-y)
FY18*	274	15.8%	168	-1.2%	113	46.2%	7	-34.1%
FY19*	129	-52.9%	142	-15.3%	7	-93.6%	20	182.1%
FY20*	131	1.7%	167	17.1%	2	-72.7%	37	82.6%

Source: Ministry of Mines, Ministry of Commerce, CARE Ratings

Table 3: Domestic overall Consumption of Refined Copper (KT)

	Primary	Secondary	Total	Change (y-o-y)
FY18*	168	68	236	1.4%
FY19*	142	61	203	-13.8%
FY20*	167	88	255	25.3%

Source: Ministry of Commerce, CARE Ratings

\*April-July

In the current financial year, there has been a marginal recovery in terms of production of refined copper but nevertheless the domestic copper production still continues to remain stressed as the Tuticorin smelter is still non-operational. As a result imports of copper cathodes have increased by 82.6% and exports have fallen by 72.7%. India has imported 86% of its copper cathodes requirements from Japan and exported 83% to China.

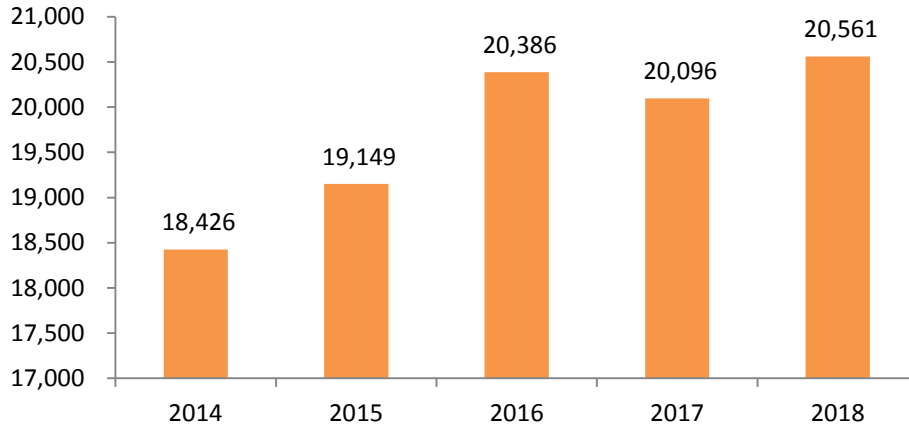
Copper consumption (primary and secondary) has increased by 25.3% which was driven by usage in the electrical sector (power, cables and transformer).

## Trends in Global Copper Industry

### Mined Copper Production

Globally Chile ranks 1<sup>st</sup> in world mined copper production followed by Peru and China. Chile contributes to the world's 1/3 mined copper production.

**Chart 7: World Mine Production (in KT)**



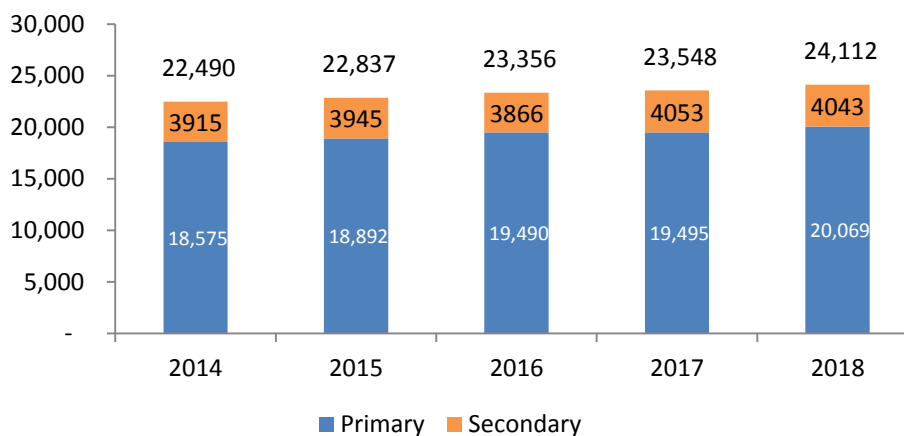
Source: International Copper Study Group (ICSG)

Global mined copper production increased at a CAGR of 2.8% during CY14-18. Global mined copper production had fallen during CY17 on account of the supply disruption caused due to the issues faced in the Chilean (Escondida Copper Mine) and Indonesian (Grasberg UG Copper) copper mines (during Q1CY17).

Chilean mine workers had gone on a strike in order to oppose the new labour laws while the Grasberg mine operator, Freeport-McMoRan was facing an issue regarding the renewal of its copper concentrate export permit with the Indonesian government. Resumption of mining activities has led to a 2.3% y-o-y increase during CY18. Democratic Republic of Congo (DRC) and Zambia had aggregated a growth of 13% during 2018.

### Refined Copper Production

**Chart 8: World Copper Refined Production (Primary and Secondary) (in KT)**



Source: International Copper Study Group (ICSG)

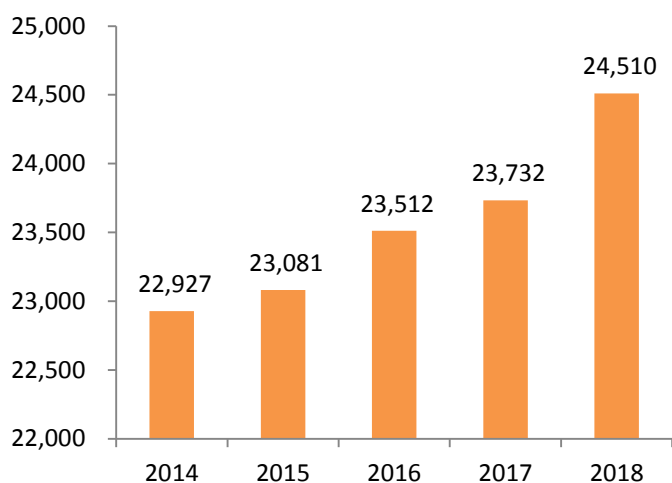
Global refined copper production has grown at a CAGR of 1.8% during CY14-18. In 2017, China accounted for 38% of world copper refined production, followed by Chile (10%), Japan (6%) and the United States (5%).

### Consumption

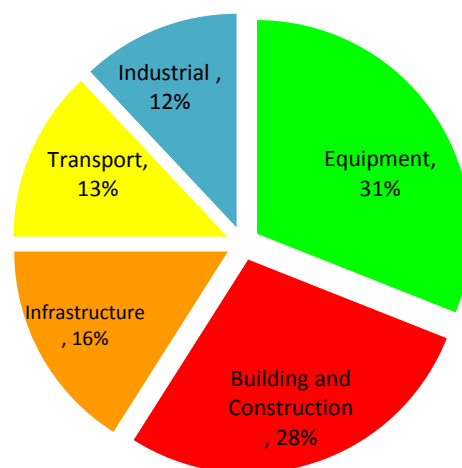
Copper is shipped to fabricators mainly as cathode, wire rod, billet, cake (slab) or ingot. Through extrusion, drawing, rolling, forging, melting, electrolysis or atomization, fabricators form wire, rod, tube, sheet, plate, strip, castings, powder and other shapes. The fabricators of these shapes are called the first users of copper. The total use of copper includes copper scrap that is directly melted by the first users of copper to produce copper semis.

Copper and copper alloy semis can be further transformed by downstream industries for use in end use products such as automobiles, appliances, electronics, and a whole range of other copper-dependent products in order to meet society’s needs.

**Chart 9: World Refined Copper Consumption (in KT)**



**Chart 10: Sector Wise Consumption of Copper Worldwide**



Source: International Copper Study Group (ICSG)

China is the largest refined copper consumer and accounts for almost half the copper usage in the world. Copper usage has increased by a CAGR of 1.7% during CY14-18.

### Copper industry during 2019

**Table World Refined Copper Usage and Supply Trends (units: KT)**

	January-June		
	2018	2019	Change (y-o-y)
World Mine Production	10,058	9,919	-1.4%
World Refined Production	11,871	11,740	-1.1%
World Refined Usage	12,047	11,960	-0.7%

Source: International Copper Study Group (ICSG)

World mine production declined by 1.4% during H1-CY19 due to reduction in output from Chilean and Indonesian mines which offset the growth in other countries. Production in Chile declined by 2.5% mainly due to lower copper head grades



and concentrate production in Indonesia declined by 55% as a consequence of the transition of the country’s major two mines to different ore zones. On the other hand production in Peru, Australia, China and Mongolia increased due to improved grades.

World refined production declined by 1.1% with primary production declining by 1.5% and secondary production (from scrap) increasing by 1%. Total Chilean refined production declined by 15% due to temporary smelter shutdowns whilst undergoing upgrades to comply with new environmental regulations. Shutdown of Vedanta’s Tuticorin also added to the decline in worldwide production. Zambian refined output fell by 28% due to power supply interruptions, smelter outages due to the introduction of a 5% custom duty on copper concentrate imports which constrained the smelter feed. Output from Japan, Peru, the United States and a few European countries also declined due to smelter maintenance shutdowns. However these reductions were largely offset by growth in Chinese output and by increases in countries recovering from production constraints in 2018 such as Australia, Brazil, Iran and Poland.

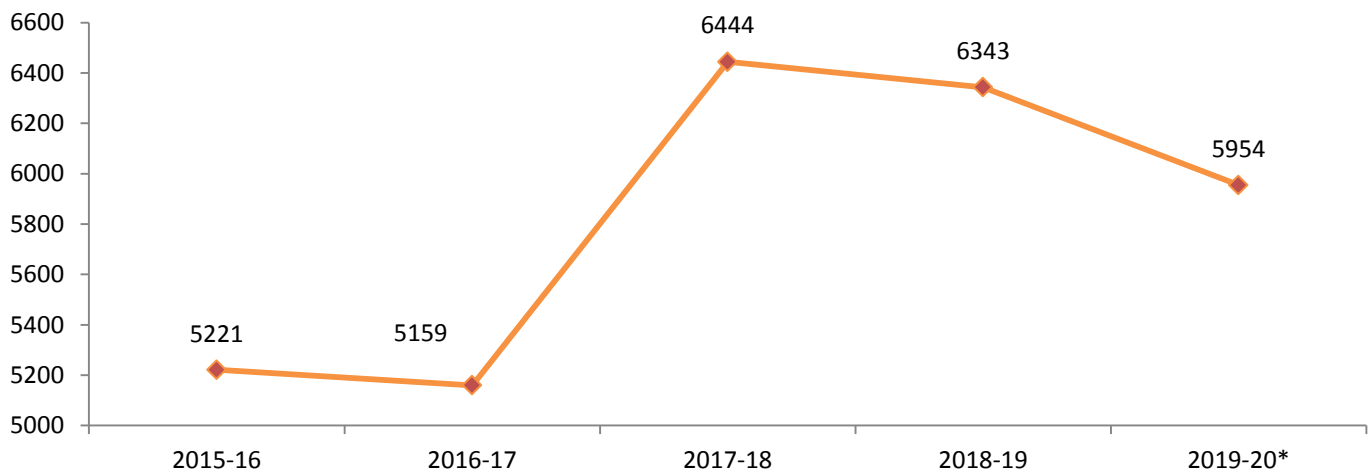
World apparent refined usage of copper has declined by 0.7% and World ex-China usage declined by 3% in the current calendar year January to June period. Although Chinese net refined copper imports declined by 16%, the apparent usage grew by around 3% given the increase in higher domestic output. Demand had increased in India and Taiwan but declined in the EU and Japan.

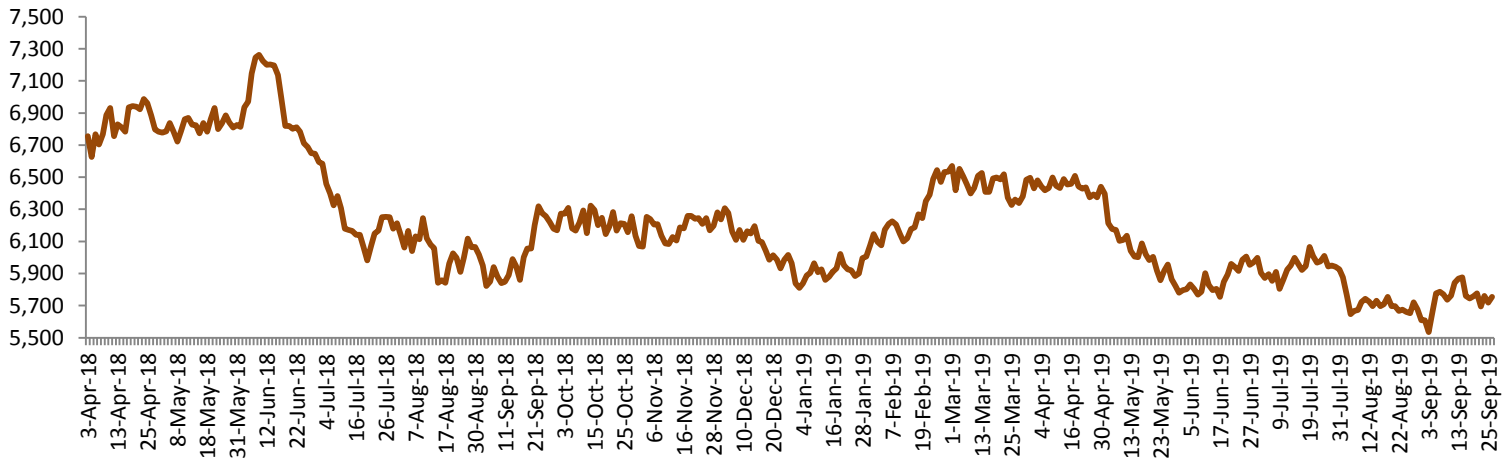
**Global Copper Price movements**

Prices of copper are usually affected by demand – supply dynamics and macroeconomic factors. LME daily publishes inventory levels of copper which also has a direct impact on the prices of copper and on the stock prices of copper producing companies.

Prices of the commodity is also influenced by the economic growth of the major copper consuming countries like China, USA, Japan and Germany and the dollar index. Growth and development of the infrastructure, telecom, real estate and electrical industry directly affect the prices of Copper.

**Chart 11: Price movements of LME Copper (USD/tonne)**





Source: LME

\*April-September (till date)

Global copper prices rose by 25% during FY18. Prices had risen on account of supply side distortions due to the disruptions in the Chilean and Indonesian mines. Price had also rallied due to pick-up of demand in China and also because of the shutdown of polluting smelters in China, which have not been following the efficiency norms. The Chinese government had taken a stance to improve the air quality and reduce pollution in the country.

Prices decreased marginally by 1.6% during FY19. The tariff war between the US and China, appreciation of the US dollar against major currencies and slowdown in the global economy led to copper prices being subdued throughout FY19.

The continued tariff war and rising tension between US and China has further continued in the current financial year i.e. FY20 which has led to copper prices to further decline.

### Financials of Copper Companies

To understand the financial performance of the copper industry we have analysed the sales/revenues and operating margins of the three major players which dominate the Indian Copper market. We have considered the segmented sales and operating profits of Vedanta and Hindalco (Copper division) and the standalone financial statements for Hindustan Copper.

The profitability of Indian Copper Companies largely depends on the Treatment Charges and Refinery Charges (TC/RC). In a nutshell it is the TC/RC is the fees smelters charge miners for processing the concentrates. They are amounts designed to cover refining costs. Now for example copper concentrate contracts may define a purchase price based on LME price on a certain date minus the TC or RC being used at the time.

Chart 12: Revenue juxtaposed with LME Copper Prices

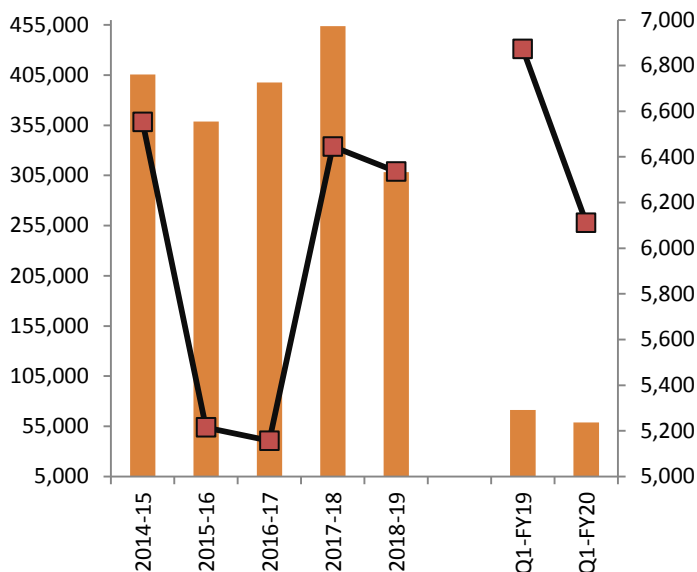
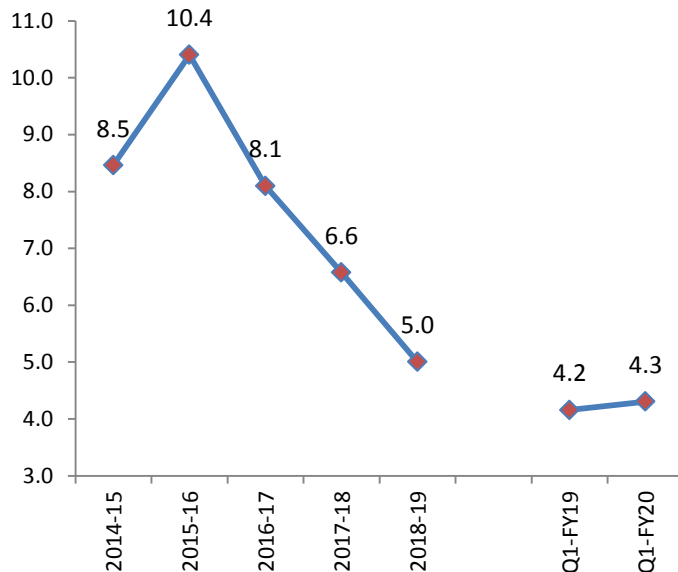


Chart 13: Operating Profit Margin (in %)



Source: Company Annual Reports, BSE

Cumulative sales revenue of the copper industry has declined by 6.6% during FY15-19. Revenues of the industry largely depend on the copper prices prevailing in the global economy. LME copper prices started declining and have been suppressed ever since due to the US-China trade war which commensurate in lowering the revenues of copper producers during FY19. Shutdown of the Tuticorin smelter too resulted in the fall of revenues by 32.1% during FY19 on a y-o-y basis. Even in the current financial year, revenues have dropped by 17.3% and copper prices have fallen by 11.1% during Q1-FY20.

Operating profits largely depend on the TC/RC margins. Higher TC/C margins are favourable to companies as it increases their profitability. Mine strikes and shortages/unavailability of copper concentrates has resulted in the fall of the TC/RC margins in the last few years which has resulted in suppressing the margins of copper manufacturers as well.

**Conclusion/Outlook:**

With the permanent closure of the Tuticorin smelter, and the uncertainty surrounding with its remission, **we believe by the end of FY20, refined copper production will be around 450 KT**, registering a 1.5% drop from its FY19 level of production.

- Production of copper till date is 167 KT (April-July).

Demand for the domestic copper market is dependent largely on the electrical & telecommunications (56%), building & construction (8%), automobiles (11%) and the consumer durables segments (8%). **We estimate domestic refined copper demand to increase by 7-8% (including consumption of scrap) by the end of FY20.**

- The growing demand from the power sector, the government’s thrust on renewable energy and increasing demand from the households for consumer durables will add onto the demand for copper in India.
- Manufacturing of hybrid and electric cars will also augment the consumption of copper as EVs use 4 times more copper than traditional internal combustion engines.

Due to the increase in demand, **India will continue being a net importer of refined copper during FY20** as well, unless the Madurai court passes the judgement for the remission of the Tuticorin smelter.

Global copper prices will be suppressed and will range between **USD 5,500-5,900/tonne**.

- Till there isn't a constructive trade deal reached between the US and China, Copper prices are going to be subdued

We also expect **TC/RC margins to remain under pressure** owing to the supply side disruptions from the major mining areas (Chile mining strike).

- This could act as a double whammy for copper manufacturers given global copper prices are already low and low TC/RC margins will affect smelters earning capacity potentially affecting the overall financials of the copper industry.

## Annexures

### Process of Manufacturing Copper

Copper is never found as a whole. When it is mined, Copper ore typically contains less than 1% of Copper. Mined Copper ore has to go through a variety of physical and chemical processes to become market ready. Market ready refined copper, refers to copper cathodes which is 99.99% pure copper. The most common types of ore are copper oxide and copper sulfide.

The first few steps in copper processing are common to both the Copper ores. After mining, the first major step in getting copper ready for market is concentration. The copper is concentrated by slurring the ground ore with water and chemical reagents. The copper is then removed with a skimmer. At the end of this step, copper concentrations are typically between 24 and 40%.

After the concentration is complete, the next phase involves creating market-ready copper. That typically takes place at a refining plant/smelter. Through copper refining, unwanted material is progressively removed and copper is concentrated up to 99.99% purity, the standard for Grade A copper.

Now the copper ore is processed according to the content the ore contains. If the copper ore is rich in sulfides it is processed through Pyrometallurgy and if the copper ore is rich in oxides it is process through Hydrometallurgy. Pyrometallurgy uses the application of heat to separate the copper ore from the sulfides whereas Hydrometallurgy uses water to extract the copper from the ore. Since each mine site is unique in its mineral composition, concentration, and quantities, the most economical and profitable processing of ore must be determined by the mine planners.

Chart: Process of copper refining through Hydrometallurgy

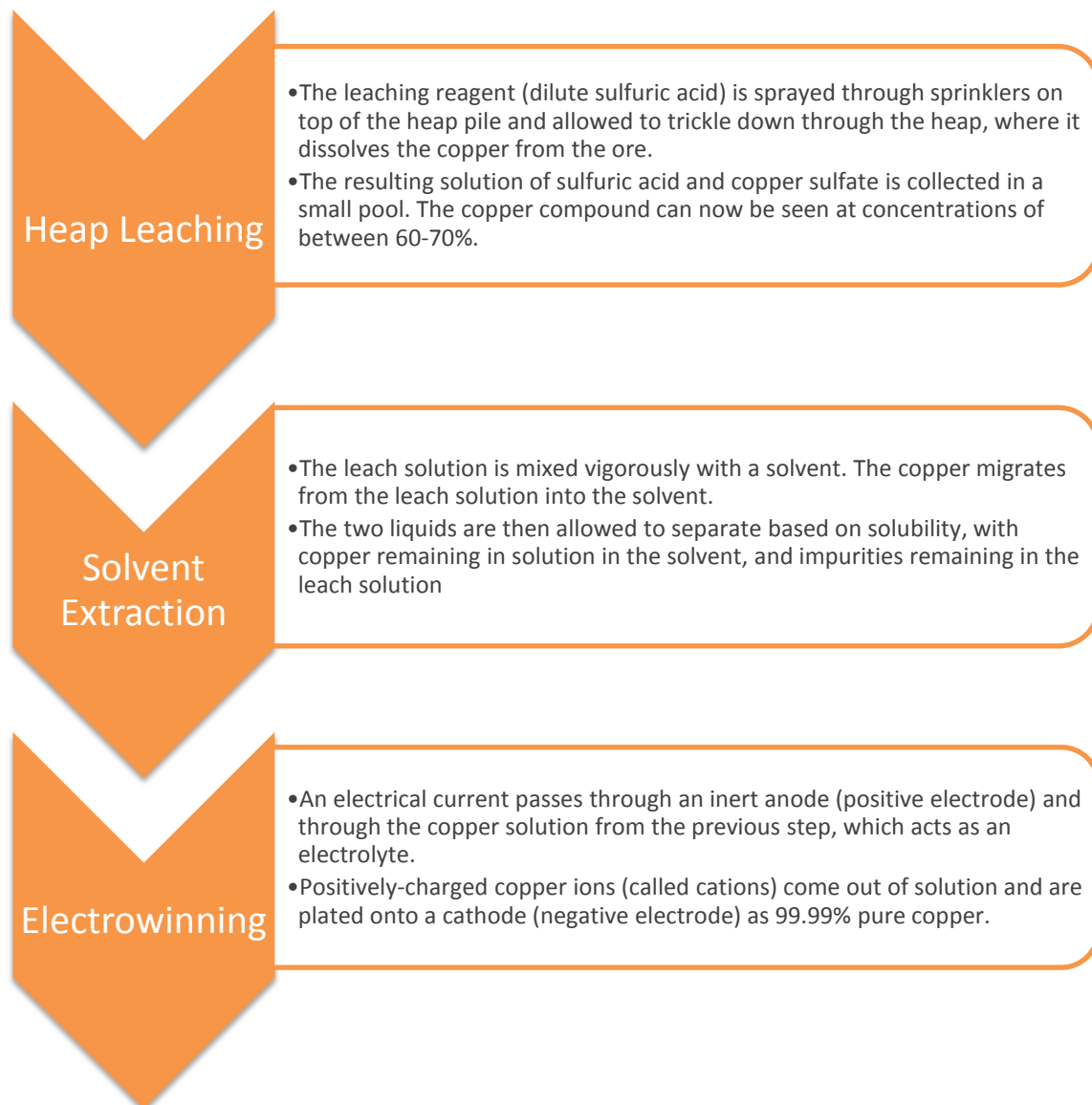


Chart : Process of copper refining through Pyrometallurgy



The finished copper cathodes can then be made into wires, plates, tubes, and other copper products. Downstream sector of copper includes value-added products such as sheet, strip, foil, wire rod, wire, etc