When Will the Price of Copper Decline?

An Analysis of Present Conditions with Regard to Demand and Supply Indicates No Immediate Hope for Reduction, Even If War Should End

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There are so many uncertain and conflicting factors which may affect the price of copper during 1917 that any forecast as to the average price would be of little value. There are a number of facts, however, which it is well to bear in mind. If the war continues for another year, the Allies will again be in the market for a large supply, and the prophecy of 40-cent ingot may be fulfilled, though it seems like an extravagant figure in any circumstance. If the war ends in a few months, the demands of the Allies for copper for war purposes will be greatly reduced. On the other hand, the German market will be opened and Germany is said to need 800,000,000 pounds of copper. It is certain she will not rush into the market at once with enormous orders and drive up the price. She must buy as economically as possible, but the opening of her market will certainly go a long way in offsetting the curtailed demands of the Allies. It should be borne in mind that copper supplies in the allied countries are under strict government control, and are used almost entirely for war purposes. Peace will bring a demand for purposes other than those of war. It will also mark the beginning of reconstruction in all the devastated sections of Europe, and for this there will be needed a great quantity of copper. The fact that a large percentage of the possible production during the first six months of 1917 is sold, must also be borne in mind. On the other hand, we must consider the fact that production in 1917 will probably exceed that of 1916, and that domestic demand is likely to show a falling off. The only safe forecast as to prices of copper during 1917 seem to be as follows: If the war continues for another year the rate of consumption abroad will enormously increase, and the high peak price may run far above that of 1916. If the war ends soon, there will be a sudden lessening of demand and a substantial drop in price, followed by a gradual reaction to higher levels as the peace demand develops. That copper will command a relatively high price as compared with 1913 and 1914 seems inevitable. Moreover, this condition is likely to prevail for several years. From the present outlook cheap copper seems a thing of the past, rather than a thing of the future.—From "Wire Message," issued by Habirshaw Electric Cable Company and The Electric Cable Company.

AN analysis of the copper situation to present facts and matters of interest to the electric light and power companies presents certain difficulties at all times, since the data necessary for a complete discussion of this important question are in part incomplete. It requires keen judgment on the part of those vitally interested in production to maintain the proper equilibrium, and also an equal amount of foresight is required on the part of the consumer in covering his requirements.

Much information is required in solving these situations, and necessary facts are never fully available, because we are always attempting, in some measure, to forecast the future. The producer has to forecast the future in regulating production and the consumer equally in determining when and to what extent to buy. At the present time, the difficulties are greatly accentuated. The principal nations of Europe are now at war with each other and the ordinary relationship of production and consumption have been disrupted, and it is beyond the power of the most astute person to foresee the duration of the war and the readjustments when peace is restored.

We have every reason to believe, however, that the demand for copper will continue heavy. Even if it were practicable now to prepare a complete and accurate analysis of the relationship of supply, demand, mill and refinery capacities, transportation facilities, etc., it would not be entirely worth while, since in the interval between the time of its preparation and its appearance in print extensive modification would become necessary. The component phases governing the picture are varying from day to day. I shall therefore not attempt to do more here than to sketch the general features of the present situation.

Coincidentally with the declaration of war, the consumption of copper increased at an extraordinary rapid rate and is now at the maximum in the history of the metal. The statistics, in Table I, plainly indicate this fact, 1916 showing an increase of 38.9 per cent.

Comparing 1914 and 1916 smelter production, the increase is 877,862,808 pounds, or 76 per cent. Comparing 1914 and 1916 consumption, the increase is 947,000,000 pounds, or 145 per cent.

TABLE I—UNITED STATES COPPER PRODUCTION AND CONSUMPTION.

Year	Smelter Production Lbs.	Annual Increase or Decrease Lbs.	Per cent	Domestic Deliveries
1908	942,570,721	.....	.....	.....
1909	1,092,951,624	I. 150,380,903	15.9	705,051,591
1910	1,080,159,509	D. 12,792,115	1.2	749,426,542
1911	1,097,232,849	I. 17,073,240	1.6	709,611,605
1912	1,243,268,720	I. 146,035,971	13.3	819,665,948
1913	1,224,484,098	D. 18,784,622	1.5	767,351,760
1914	1,150,137,192	D. 74,346,906	6.1	*653,000,000
1915	1,388,009,527	I. 237,872,335	20.7	*1,077,000,000
1916	1,928,000,000	I. 539,990,473	38.9	*1,600,000,000

(*) Estimated.

For matters of analysis and comparison, it is estimated that the U. S. consumption of 1913 may be classified as shown in Table II.

TABLE II—CONSUMPTION IN 1913.

	Pounds	Per cent
Copper wire	400,000,000	52.1
Brass mills	220,000,000	28.7
Copper sheets	105,000,000	13.7
Miscellaneous (chiefly coating and alloys)	42,000,000	5.5
Total	767,000,000	100.00

If we assume the normal business of the country to be as is represented by the year 1913, it will be seen that the war demands have increased our home consumption nearly one billion pounds, and increased mill outputs, roughly, 108 per cent—a remarkable task. It remains to consider:

(1). Whether the increase may be expected to continue.

(2). Are our resources sufficient to meet the demand?

These are the problems which we in the copper business must face, either as producers or consumers, and, as intimated previously, our expertness will be determined by our ability to forecast the future.

January 1, 1917, is unique in the history of copper production. Not a pound of unsold copper existed. This state-

ment applies not only to copper ready for shipment, but to a large extent to copper in transit and in partial stages of treatment. Furthermore, producing capacities were practically sold to 100 per cent capacity for the first six months of 1917, and large orders were ready for later commitments if the producers were able to take care of them.

Electric power and street-railway companies recognize the difficulties attendant on their morning and evening peak loads and, in their parlance, we have a peak load for the entire 24 hours and steady for six months, with prospects of the same condition existing for the last six months of 1917.

The Enormous Consumption of Copper for Ammunition.

Let us look at the situation more in detail: Heavy sales made for export requirements for the first half of 1917, in addition to the abnormal demand for domestic consumption, denuded the market of copper for this period. Some idea of this demand can be obtained by taking one item of copper consumption alone, namely, ammunition. The amount of copper used for this purpose, chiefly as brass, is utterly astounding. Cartridge cases and shells are made from brass containing 70 per cent copper and 30 per cent zinc. The ordinary army cartridge contains 23,000 to 28,000 pounds of copper in a million cartridges, according to the make of the rifle. A three-inch rapid-fire gun uses a cartridge weighing 1 pound 5 ounces, a six-inch gun takes a cartridge weighing 28 pounds 13.5 ounces, and so on, increasing in copper consumption as the size of the gun increases. All shrapnel and high-explosive shells require a copper compression ring, or shell band, to enable the projectile to follow the rifling in the guns; these rings will average from 2.5 pounds upwards in weight. A new type of bullet now being used extensively in Europe is made of brass, containing 90 per cent copper and 10 per cent tin.

The common antimonial lead bullet is encased with a cupro-nickel jacket, usually 85 per cent copper and 15 per cent nickel. It is estimated that before the war 20,000,000 pounds of copper was consumed annually by the ammunition makers in the United States, and that during 1916 this consumption jumped to more than 700,000,000 pounds.

An interesting statement in this connection, and showing the relation between certain materials, is the list of metals covering a specific war order, shown in Table III.

TABLE III—COPPER ENTERING INTO A SINGLE MUNITION ORDER.

Material	Rough Weight Tons		Finished Weight Tons
Steel	141,953		70,977
Brass..... 30% zinc— 8,145 tons 70% copper—19,635 tons	28,050	4,208.7 9,200.3	14,029
Copper	3,630		1,815
Copper total, including copper in above brass	23,265		11,015.3
Lead, approximate	30,000		18,079
Tin, sheet	300		211
Miscellaneous	.....		10,038

From Table III it is seen that the copper weight is 11 per cent of the total weight of the shells.

The various mills producing sheet, wire and copper products in the United States have a capacity of about 140,000,000 pounds of copper per month, and added to this excessive demand for copper is the export requirements of the Allied Governments, amounting to 60,000,000 to 85,000,000 pounds of raw copper per month. Consequently, as the present 100 per cent producing capacity of the copper industry is about 200,000,000 pounds per month, it can be seen that the present demand is in excess of the supply.

Demands of Railways.

It may be of interest to give some figures as showing to what extent the street railway and electrified steam railroads are users of copper.

The street railways are large copper consumers; the ordinary city electric car will contain from 1,000 to 2,500 pounds of copper, and some of the large interurban cars will have nearly 4,000 pounds. As illustrating the use of copper, I have taken a street-railway system in a city of about 150,000 people; power is supplied from one central-station engine-driven direct-current unit. The copper used is approximately as shown in Table IV.

TABLE IV—COPPER USED IN A TYPICAL STREET-RAILWAY SYSTEM.

	Pounds
Feeder system	2,433,000
Overhead trolley	528,000
Track bonding and special work	225,000
Car equipment	510,000
Power house	46,000
Total	3,742,000
Number of cars operated	550
Total mileage based on single-track miles	176
Capacity of generating stations	6,800 kilowatts
Average copper per mile of track	21,400 pounds

The amounts in Table IV do not include the copper in the store room.

Many electric roads will show a smaller figure, and some in large cities, such as New York, Boston, Chicago and San Francisco will show a higher figure, but even assuming a figure of only 15,000 pounds of copper per mile, and considering that there are approximately 45,000 miles of electric railways in the United States, approximately 675,000,000 pounds of copper is used.

A considerable amount of new copper is used annually to maintain the electrical equipment on electric railways—windings burn out or the insulation is damaged; commutators wear, controllers and circuit-breaker parts become damaged; the trolley wire breaks or partly wears out; all the copper in these parts is sold for scrap and new copper purchased.

Steam Railroad Electrification in the United States.

Several examples only out of many installations are given as illustrating the extensive use of copper by large electrification projects.

TABLE V—NORFOLK & WESTERN RAILWAY—ELKHORN GRADE—BLUEFIELD ELECTRIFICATION.

	Pounds
Transmission	175,000
Distribution, including trolley, feeders, etc.	377,000
Track-bonding	87,000
Ground-plates	55,000
Locomotives	300,000
Transformers	70,000
Generators	56,000
Switchboards, wiring and miscellaneous	25,000
	1,145,000
Total single-track mileage, miles	90
Amount of copper used per mile of track	12,700 pounds

TABLE VI—BUTTE, ANACONDA & PACIFIC RAILWAY.

	Pounds
Substations	29,750
Locomotives	173,700
Distributing system, trolley, feeder cable and track bonds	916,382
	1,119,832
Total single-track mileage, miles	95
Amount of copper used per mile, pounds	11,800

TABLE VII—CHICAGO, MILWAUKEE & ST. PAUL MAIN LINE FROM HARLOWTON, MONT., TO AVERY, IDAHO.

Approximate main line distance, miles	440
Miles electrified, Deer Lodge-Harlowton, single-track basis	321
Copper in substation equipment, locomotives, transmission and distribution systems, pounds	7,550,000
In addition, the signal system will use approximately, pounds	250,000
Additional telephone facilities in connection with this work will require, approximately	110,000
Total copper, pounds	7,910,000
Amount of copper used per mile of track, pounds	24,600

The amount of copper shown in Table VII (7,910,000 pounds), only applies to half of the electrification; that is, Deer Lodge-Harlowton. The complete electrification from Harlowton, Mont., to Avery, Idaho, will use approximately 15,000,000 pounds.

From the above, and considering improvements in the way of voltages, 10,000 to 25,000 pounds of copper per mile

may be considered to be an average minimum figure for future work. If all of the railroads in the United States were electrically operated it would require the world's entire output of copper for two years at the present rate of production, the mileage being approximately 330,000 miles on single-track basis.

In almost every line of endeavor in the business and manufacturing world copper is becoming more and more necessary and the consumption is increasing constantly.

Another factor very seriously influencing and restricting capacities is the transportation difficulties at this time due to extreme congestion between Minnesota and Buffalo; that is, the middle west cities. Copper in transit from mines to refineries on the eastern seaboard takes between 30 and 60 days at present, where heretofore the usual time required was 21 days. In fact, at the present time some of this copper is being routed as an expedient over southern lines, other shipments being sent to Galveston, Texas, and then by water routes to New York harbor. This situation is now very acute and it will take at least a month of continuous good weather to even approach normal conditions.

No Lower Prices in Sight.

With our own government coming into the market for enormous munitions, the domestic and foreign governments inquiring for copper for the second half of 1917—and these are no idle phrases—no recession from present price levels seems possible. Any prospective purchasers of copper, requiring same during the next six months, as wire, sheet or any other manufactured shape, should be concerned not so much about the price but whether or not it will be possible to obtain it at all in the quantities required. Prices will be high certainly, but the pinch will be in making satisfactory deliveries.

Due to the very high prices of copper for many months past, the purchasing of copper wire and cable in many instances has been greatly curtailed because it makes the investment a relatively large one when compared with similar material installed in normal times. The business in power-transmission wire and cable has been very light; the street-railway people have purchased only for their imperative needs. Electric lighting companies have purchased a little more freely than others, which is natural, because of the increased business they have had offered to them from night work in factories, increased use of power for manufacturing purposes, etc.

The absence of the normal amount of wire and cable for hydroelectric plants and street railways has not been a hardship in the wire and cable mills; perhaps it has been a rather welcome relief. There has been such a tremendous demand for copper wire and cable for other uses that, as a matter of fact, the mills have been unable to meet the needs, even by working night shifts. At the present time, in most classes of wire, the mills are asking customers to specify their needs three or four months in advance, and the indications are that these conditions will prevail for some time, and even become more acute.

Just what the future will be is hard to forecast, but it is evident that, considering the conditions which exist now, it would be well to carefully study your wire requirements, and place your orders with the mills in plenty of time to allow for delayed shipments or even longer deliveries.

UNDERGROUND CONSTRUCTION COSTS AT BOSTON.

Discussion of Various Items Entering Into Cost of Street-Lighting Before Massachusetts Commission.

Hearings before the Massachusetts Gas and Electric Light Commission, sitting as a board of arbitration to determine the reasonableness of the Boston Edison Company's rates for street lighting of Boston, have thus far run more than 80 days, having been begun early last spring. About 7,000 typewritten pages of testimony have been taken. Recent sessions have been taken up with the consideration of exhibits and testimony of Professor Harry E. Clifford, of the electrical engineering department of Technology and Harvard University, who is retained by the City of Boston and has made an independent study of investment costs bearing on the lighting service.

At a recent hearing Professor Clifford testified that in his opinion $446,370 was a fair charge for the total investment in conduits, manholes and transmission cables supplying Boston's street-lighting service. The company's figure was $581,600. He held that there were actually 12,000 feet of transmission cables less than the company's exhibit showed. In response, F. M. Ives, counsel for the Boston Edison, pointed out that it had accurate measurements of the lines on the whole system taken since the exhibit was first put in, and they checked within one per cent against earlier figures. On the other hand, the city's representatives had examined only about 35 manholes selected at random, and based its figures on averages. It appeared that the discrepancy resulted from leaving out of account the actual length of racking at the manholes.

A question arose as to what portion of the investment in lines outside the city that are laid to feed back into the city system from suburban substations should be included in the investment account. Commissioner Lewenberg suggested that a tie line connecting a Boston substation and service in the suburban town of Milton might properly be divided between Boston and that town, since it served as an insurance against breakdown to both systems.

Regarding the proper installed price for three-conductor 4-0 cable at the time under discussion, 1914, Professor Clifford reckoned 98 cents per foot as compared with the company's figure of $1.20. It was assumed by the city's expert that the fair price of this type and sized cable over a term of years up to 1914 was 80 cents per foot.

The company's figures showed 85.9 cents as the average price of all cables purchased. Professor Clifford allowed four feet per manhole for waste, as against 10 feet by the company.

Regarding cost of inspection, the company's estimate of 0.6 cent per foot was accepted as a proper charge. The company's figure for drawing in and splicing was 10 cents per foot. Professor Clifford pointed out that a contract with a contracting firm for one job was at the rate of 5.5 cents per foot. This figure was based on a calculation of eight cents per pull for each manhole, 20 manholes to the mile.

The company's figures of 43 cents a foot for wrapping 240 feet of cable per mile, or 12 feet to each manhole, and of 0.5 cent per duct foot for rolling ducts, were not disputed. The figure of $1.29 each for bonding manholes was also accepted.

The Edison Company's figure for high-potential testing was $50 per mile. The city's expert claimed this figure was excessive. He pointed out that the outfit required is a motor truck carrying apparatus for securing the necessary current. Such an outfit was offered to himself for railway testing at $50 per day. He held that a four-mile cable could be tested in half a day, after laying. He believed it to be the right practice to lay the whole length of cable from one terminal to the other before making the test, except in exceptional circumstances. If a cable breaks under test, one can then make a loop test for locating the fault between manholes.

The figure of the company for inspecting and tagging, $1.00 per manhole, was cut in half; Professor Clifford thought the tagging could be done with the splicing and racking.

For terminals in stations, Professor Clifford adopted the company's price, viz., $100 for every two miles of cable. Likewise, for teaming and return freight on reels, the company's figure of $8.25 per reel, 21 lengths and 14 reels per mile.

Watchmen, pumping, cleaning and overtime, were entered by the company at $50 per mile. The city's expert reduced this figure to $25, on the ground that the contractor doing the construction usually supplies watchmen, lights and care.

For incidentals, engineering, etc., for which the company charged 15 per cent, $150 per mile was assumed as fair.