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THE PROSPECTS FOR ALUMINUM

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Table of Contents

SUMMARY AND CONCLUSIONS

1. In spite of the present surplus of aluminum, by the mid-1960's there will be a need for additional smelting capacity over and above that now existing or presently planned for construction in Europe, the United States and Canada. This new capacity will be required to meet the anticipated growth of the markets in Europe and the U.S. Part of the U.S. requirements will probably be supplied from increased domestic production; but because of a lack of suitable power sites on the Continent, Europe's growing needs must be met largely from imports. The purpose of this paper is to estimate the probable development of Europe's growing import needs and to consider the ways in which they may be filled.

2. A feature of the recent development of the aluminum industry has been the shift in the center of production and consumption from Europe to North America with the result that whereas before World War II consumption was about equal in the two areas, today twice as much aluminum is consumed in North America as is consumed in Europe. There is reason to believe that the lag in European consumption is not due so much to basic economic factors as to unusual conditions brought about by World War II - the most important being great differences in the conditions of supply between the two areas.

3. The importance of supply conditions is reflected in the estimates of market growth for Europe and the U.S. In spite of the great differences in levels of consumption, both markets are expected to grow at about the same rate (8%) for the period 1956-65. In the case of the U.S., the aggressive development and promotion of new uses typical of the industry is a particularly favorable factor. In the case of Europe, the fact that aluminum consumers must depend on virtual national monopolies or imports for their supplies may be expected to inhibit to some extent the expansion of the market. However, it is recognized that a major change in the conditions of supply might have a stimulating effect on the European market and demand might grow more rapidly than estimated. After 1965 it is expected that demand will grow faster in Europe than in the U.S.

4. On a world-wide basis present plans for expanding aluminum capacity will be about in balance with expected demand by 1961; by 1965 more capacity than presently planned will have to be built in order to supply the anticipated market. Some of this will probably be built in the U.S. to meet growing domestic requirements. However Europe, the other principal market, can supply its expanding market only through imports.

5. It is estimated that Europe's import requirements will be approaching 700,000 tons of aluminum a year by 1965 and that they will be increasing at a rate of about 100,000 tons a year by this time. These requirements can be supplied from Canada, Africa, or possibly to some extent from the U.S.S.R., which has recently increased its exports of aluminum to Western Europe. An analysis of each possible source results in the conclusions that:

(a) Canada may be expected to be the principal supplier of European import requirements up to about 1965.

(b) African supplies may enter the European market at about this time or shortly thereafter and may be expected to supply an increasing share of European requirements in the late 1960's. The market for African metal could reach 1,000,000 tons by 1970.

(c) Russian exports of aluminum are not expected to become a major factor in the European market. The quality of Russian raw materials and the location of the major planned expansion of the industry in Siberia would place Russian production for the European market under a severe disadvantage as compared with production in Canada or Africa. Although shipments to Europe may fluctuate, in general they are not expected to exceed marginal amounts in terms of the total market.

6. The Canadians dominate the world trade in aluminum and most of the metal shipped between countries moves at the Canadian export price of 22½¢ (U.S.) a pound. The Canadians are expected to retain their position as "price leader" in the export field and no significant change is expected in the present level of prices at this time. A key factor in the long term price will be the cost conditions prevailing in the new producing areas.

THE PROSPECTS FOR ALUMINUM

Introduction

1. In spite of the present surplus of aluminum, it is generally believed that by the mid-1960's there will be a need for additional smelting capacity over and above that now existing or presently planned for construction in Europe, the United States and Canada. Some of this new capacity will be required to meet the anticipated expansion of the U.S. market. This portion will probably be built partly in the U.S. based on domestic resources of cheap fuel, and partly in Canada where cost conditions are more favorable. The other large portion of new capacity will be required to meet the expected growth in European consumption. In this case, however, because of the scarcity of suitable power sites on the continent, the anticipated demand cannot be met on an economic basis by expanding European production. Europe's growing requirements must be supplied increasingly from areas more advantageously situated for the economic production of aluminum. There are three possible sources for these requirements, Canada, which still has vast untapped hydro resources; Africa, where the presence of bauxite and hydro resources together has stimulated the planning of a number of large schemes; and possibly the U.S.S.R., which has recently increased its exports of aluminum to Western Europe and which appears to have both the resources and the intention to considerably expand its aluminum production.

2. Because of its central importance to the development of world trade in aluminum and to the opening up of new sources of supply, this paper focuses on Europe's position in the world aluminum industry. This involves: (1) estimating the probable development of Europe's growing import needs in the late 1960's and (2) considering the probable role of each of the potential suppliers in meeting these requirements. This in turn involves an examination of the relative position of each of the suppliers, together with the requirements of other markets. In the case of aluminum the prospects for the mid-1960's have a particular relevance today because of the time required to construct new smelting capacity. The pattern and volume of supply in 1965 will be affected in large part by investment decisions to be taken within the next year.

3. The paper is divided into four parts. Part I discusses the present situation and the recent developments in the world's principal markets for aluminum. In Part II estimates of the probable growth of demand in these markets are developed. Part III deals with the prospects for supply based on existing plans for expansion, the future balance of capacity and demand on a world-wide basis, and, in particular, the probable development of Europe's import requirements. In Part IV the various ways in which Europe's requirements may be met are discussed and a probable pattern of development is suggested.

I. RECENT DEVELOPMENTS AND THE PRESENT SITUATION IN THE WORLD'S ALUMINUM INDUSTRY

A. The General Pattern of Production, Consumption and Trade

4. In the rapid development of the world's use of aluminum a number of important trends can be observed which are of significance to an assessment of the future prospects for the metal. One of these has been the shift in the center of production from Europe, where over half of the world's aluminum was produced prior to World War I, to North America where three-fourths of it is now produced. 1/ This shift took place largely as a direct result of World War II. However, a movement in this direction based on the attraction of cheap power in North America had commenced earlier, although it was obscured in the 1930's by a combination of the U.S. depression and German rearmament. While U.S. and Canadian production did not regain 1929 levels until 1937, German aluminum production increased about 10 times between 1933 and 1939, raising the German share of world output from 13% to almost 30%. The shifts of the pre-war years, however, were dwarfed by the tremendous impact of the war itself. Between 1938 and 1943, the year of peak wartime production, the production of aluminum in North America increased 6½ times while that of Europe rose by only 40%. The resulting division of production, roughly 3 tons in North America to every ton produced in Europe, remains to this day, although the total output of the two areas is now 50% above the wartime peak.

5. The wartime expansion of aluminum production in North America was greater than the requirements of the area and during the war considerable quantities of metal were shipped to the U.K. and the U.S.S.R. After the war both production and consumption declined but recovery was rapid and by 1950 the 1943 level of consumption was regained in the U.S. - based largely on the spectacular expansion of civilian use. This level was some seven times that of pre-war. After the start of the Korean War in 1950 military requirements again played an important part in the expansion of the industry and by 1952 production had regained its wartime peak. The export surplus built up during the war remained and the area has since become increasingly important as a supplier of aluminum to the rest of the world.

6. A second related trend has been the shift in the center of consumption from Europe to North America. In the early 1920's approximately the same amount of aluminum was consumed in Europe and North America. Today with consumption about 15 times greater, twice as much is consumed in North America as in Europe. This trend was temporarily reversed during the 1930's for the reasons already noted. However, even though consumption has grown less rapidly in Europe than North America, production of aluminum

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1/ Unless otherwise indicated the term "world" as used in this paper does not include the Soviet Sphere. At present Europe and North America account for about 95% of production and use in the non-Soviet world. Production and consumption in the Soviet Bloc is estimated to be about one quarter that in the Free World. The Soviet area is self-sufficient in aluminum having both resources of bauxite and hydroelectric power. Recently Russia has exported aluminum to Western Europe and the U.K. and the prospect for this trade is an important element in the assessment of future market conditions. This subject will be dealt with specifically in Part IV.

has grown even more slowly with the result that Europe has become increasingly dependent on imports - the counterpart of North America's growing export surplus. These developments are illustrated in Table 1 and Figure I.

7. In terms of specific countries the U.S. is both the leading consumer and producer accounting for 60% of world consumption and 54% of production. It also accounts for 95% of North American consumption and 75% of production for this area. Canada produces the other 25% and is the world's major exporter of aluminum, supplying in recent years slightly over 10% of U.S. and about 30% of European requirements of primary aluminum. Canadian exports to Europe are mainly exports to the United Kingdom and the growth in Europe's net imports of aluminum has coincided roughly with the growth in the U.K.'s imports. Continental Western Europe is about self-sufficient in aluminum at the present time with Norway and Austria the chief exporting countries and Benelux, Germany and Sweden the most important importers. (Details for world production, consumption and trade are shown in Appendix Tables I, II and III).

8. 70% of European consumption is at present accounted for by three countries, the United Kingdom, France and Germany; the U.K. and the six Common Market countries 1/ account for 80%. Since pre-war important shifts have taken place in the relative positions of the principal European consumers. The U.K. has increased its share of Europe's consumption from 15% to 33%, and French consumption has increased from 10% to over 15%. Correspondingly pre-war Germany and Austria together accounted for 58% of the aluminum consumed in Europe while Western Germany today accounts for about 20%. The effect of these shifts on the levels of per capita consumption is shown in Table 2.

B. The U.S. and European Markets

9. A particularly significant feature of the present pattern of world consumption is the great disparity between the use of aluminum in the U.S. and in Europe which has developed since the pre-war years. This is clearly revealed in Table 2 and treated in more detail in Appendix A. It is of particular relevance to the future prospects of the European market for aluminum to consider to what extent this disparity appears to be the result of basic economic factors and to what extent it may be attributed simply to a lag in the development of the market which is of an essentially temporary nature.

10. Although the present position seems distorted in favor of the U.S., the opposite was probably true in the case of the pre-war market and this tends to exaggerate the change that has taken place. 2/ Furthermore, an additional portion of the change must be attributed to the war-induced growth in disparity in income between Europe and the U.S. 3/ and it may be that the

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1/ France, Germany, Italy, Belgium, Netherlands and Luxembourg.
2/ The levels of consumption in 1935-38 reflected rearmament in Europe on the one hand and the depressed economic conditions in the U.S. on the other.
3/ Whereas income per capita in the U.S. is now estimated to be about double that in the U.K., France and Germany, before the war it was about 40% higher - based on OEEC Comparative National Products and Price Levels and Economic Staff studies of growth rates.

Table 1

Production and Consumption of Primary Aluminum
The Changing Position of Europe vis-a-vis North America

	1901-1910	1911-1920	1921-1930	1931-1940	1941-1950	1951-1955	1956
				EUROPE			
% World Consumption	58	58	45	65	36	31	32
% World Production	57	46	51	62	32	22	22
Net Position	-1	-12	+6	-3	-4	- 9	-10
				NORTH AMERICA			
% World Consumption	42	42	51	29	58	66	63
% World Production	43	54	49	35	66	76	75
Net Position	+1	+ 8	-2	+6	+8	+10	+11

Source: Data from Metal Statistics 1941-56 Metallgesellschaft, Frankfurt. Soviet Sphere excluded.

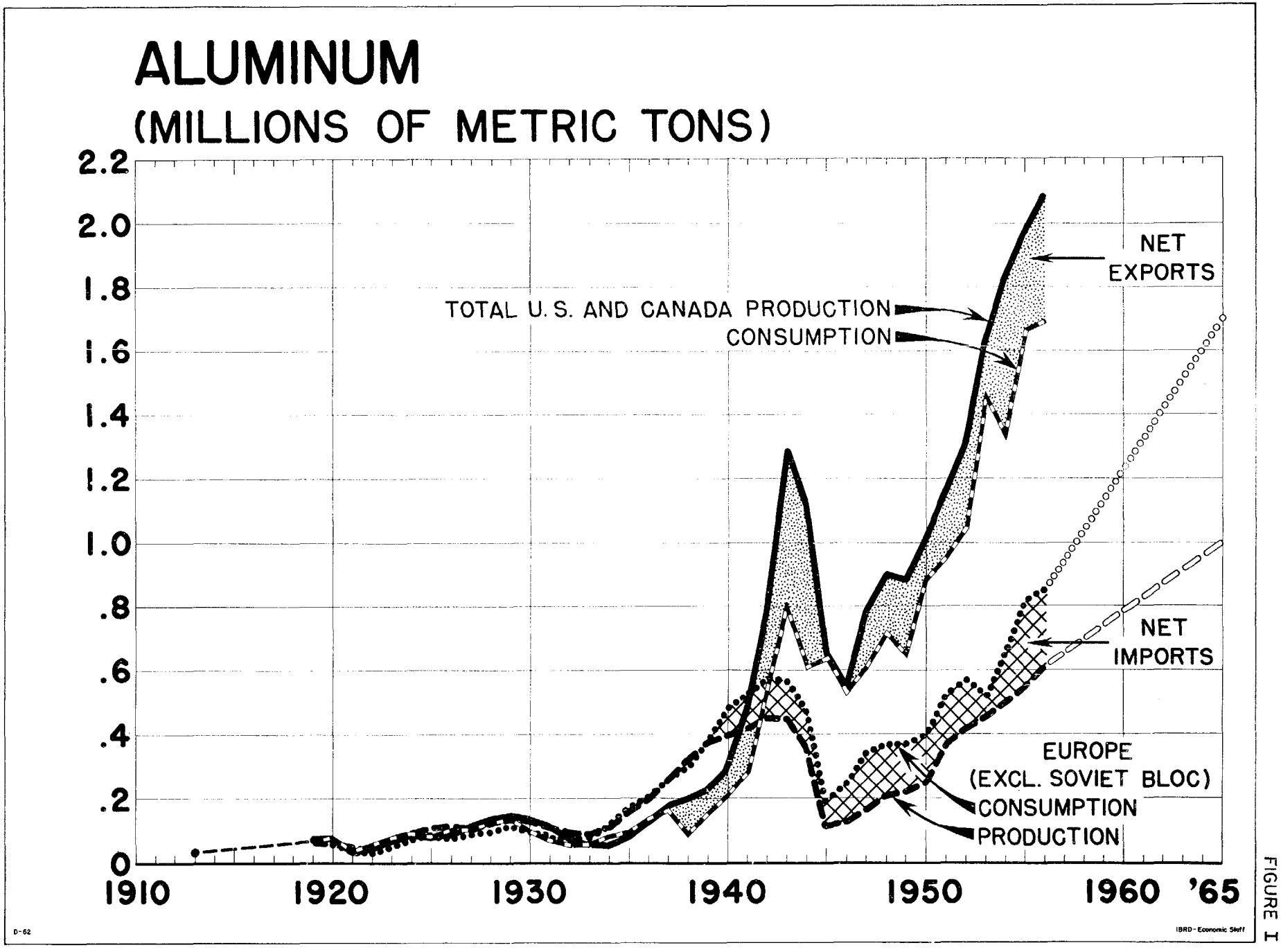
ALUMINUM
(MILLIONS OF METRIC TONS)
2.2
2.0
1.8
1.6
1.4
1.2
1.0
.8
.6
.4
.2
0
1910
1920
1930
1940
1950
1960
'65
TOTAL U.S. AND CANADA PRODUCTION
CONSUMPTION
NET EXPORTS
NET IMPORTS
EUROPE (EXCL. SOVIET BLOC)
CONSUMPTION
PRODUCTION
D-62
IBRD - Economic Staff

FIGURE I

Table 2

Consumption of Aluminum
(Pounds per Capita)

	1935 - 8	1956 1/
United States	2.0	25.6
United Kingdom	2.1	12.8
Common Market	2.3	7.1
France	1.4	8.1
Germany	4.1 2/	10.5
Belgium-Luxembourg	.8	4.0
Netherlands	.1	3.5
Italy	1.0	4.2

1/ Includes primary and secondary.
2/ A great part of German consumption during this period must have been for military use. This is much less so in the case of the others. In 1956-7 military use is negligible in Europe and of relatively minor importance in the U.S.
Source: 1935-8 - Minerais-Metaux.
1956 - Aluminium Ltd., Montreal.

Table 3

Pattern of Post War Economic Growth in U.S. and Europe
Average Rates of Growth 1948-55

	Europe[1/]	U. S. A.
GNP	5.5	4.4
Industrial Production	8.4	4.9
Basic Metal Industries	9.8	4.7
Metal Product Industries	10.0	6.5
Steel	7.1	4.4
Aluminum	10.9	12.7
Copper	5.2	1.4

1/ O.E.E.C. countries.

effect of income differences is magnified by a particular sensitivity of aluminum demand to income when income exceeds a certain "threshold" level. To the extent that factors such as these can account for the observed disparity in consumption there is no lag in the sense that this term is used here and consumption is roughly what should be expected considering the basic economic forces involved. However the above factors do not seem adequate to explain the observed gap. The major argument for this conclusion is based on a comparison of the conditions in Europe and North America that gave rise to the present situation. When these are considered it is seen that to a large extent the gap must be attributed to factors which were characteristic of the particular period and which may not be expected to persist in the long run.

11. The tremendous growth of capacity in North America during the war has already been mentioned. The existence of this capacity which exceeded any previous levels of civilian demand tended to keep the price low, (the post-war price of aluminum has been less than one half its pre-war price in real terms) to stimulate active promotion of aluminum and the development of new uses and in general to change the industry from one typified by small volumes and high prices to one of large volumes and low prices. These changes were undoubtedly stimulated by the advent of two major producers, Reynolds and Kaiser, which joined the traditional single American producer, the Aluminum Company of America (Alcoa), immediately after the war. The effect of this change in the structure of the industry was probably felt most strongly in the drive to develop new uses for aluminum. In addition to these factors within the industry there existed a considerable labor force familiar with the use of aluminum as a result of wartime experience making the promotion of new uses very much easier than it otherwise would have been. These conditions together with the economic boom of the post-war years with the great increase in production of consumers' durable goods and housing largely account for the resulting spectacular growth of the commercial market for aluminum.

12. In Europe, on the other hand, the situation was quite different. Instead of surplus capacity there was a shortage of aluminum. Capacity was expanded little during the war and even this was more than offset by the destruction or immobilization of plants. At the same time imported metal was no adequate substitute for the domestic product in most of European markets because of the scarcity of dollars. Instead of low prices, there were high prices. With the exception of the U.K. where prices were kept low owing to special contracts with Canada, prices in a number of major markets were considerably above the level of Canadian and U.S. prices. Instead of a vastly increased familiarity with aluminum the metal was little more widely known than before the war. Furthermore, while the economic expansion in Europe during the reconstruction years was rapid, unlike the U.S., the structure of production was more heavily weighted by reconstruction activities whose potential aluminum consumption was relatively low under the traditional pattern of aluminum use in Europe. As a result of all these factors the post-war growth of aluminum consumption in Europe was slower than that in the U.S. even though it started at a much lower level and even though other measures of economic activity were expanding more rapidly in Europe as shown in Table 3.

13. Essentially U.S. consumption of aluminum has far out-distanced that of Europe largely as a result of special war-induced conditions. Although there was a basis for a trend in this direction before the war, the war appears to have exaggerated and distorted the relative position of the two areas. Specifically it has been the great differences in the supply of aluminum that has been the primary cause of the disparity in consumption, a factor which has had an unusually strong effect because of the trade problems of the post-war period. Insofar as the supply situation is improved in the future and efforts are increased to widen the uses of aluminum, a considerable increase in European consumption would not appear to be limited by income levels. Furthermore, the rapid development of the market for aluminum in the U.S. has provided examples of new uses and processes that should make expansion of the European market easier than it otherwise would be.

C. Recent Trends

14. As the military requirements of World War II came to an end, aluminum consumption dropped abruptly. In 1946 about half as much aluminum was consumed in the Free World as during the peak war year of 1943. However, the recovery was rapid. Aided by the expansion of commercial applications and, for several years following Korea, by a large U.S. defense program 1/ the wartime levels were soon equaled and exceeded and consumption expanded steadily through 1955. In 1956, however, the expansion slowed down and in some markets consumption actually declined though the overall level remained slightly above that of 1955. There was some decline in 1957 followed by a slight increase in 1958 with the result that from 1955 through 1958 world consumption increased only slightly (see Appendix Table II). However, by mid-1959 consumption was again expanding rapidly in major markets. In July 1959 the U.S. Department of Commerce estimated that shipments to U.S. consumers for the year might run 25-30% above the 1958 level.

15. Though there was no actual decline in consumption from 1955 to 1958, the expansion of capacity that took place during these years resulted in the creation of a considerable surplus in the industry. U.S. capacity which was more than doubled in the period 1950-55 under the stimulation of the Korean defense program was increased 30% between 1955 and the fall of 1958. At the present time plants "under construction" represent an additional 20% of present capacity. The Canadian experience has been similar. As a result, it was estimated that 25% of the industry in the U.S. and Canada was idle in the fall of 1958. In early 1959 when Canadian long-term contracts to supply U.S. producers ran out and business picked up in the U.S., some of the burden of idle capacity was shifted onto the Canadian industry. While the U.S. industry was running at close to 90% of capacity by mid-summer, the Canadians were only operating at 65% of capacity.

1/ In 1952 30% of aluminum consumed in the U.S. was for direct military uses. This proportion has dropped steadily since then to a level of about 6% in 1958. During 1943, the peak war year, direct military uses accounted for 87% of U.S. aluminum consumption.

16. In addition to the appearance of idle capacity there was a considerable increase in government purchases of aluminum in 1957 and 1958 under the "put-right" provisions of contracts set up to encourage expansion during the Korean War. Under these provisions the U.S. government took 295,000 tons in 1957 and 320,000 tons in 1958. These amounts were over 15% of total supply of primary aluminum available in these years. Since most of the contracts expired in 1958, government purchases are expected to be only about 45,000 tons in 1959. These purchases have tended to soften the effect of the 1957-58 "slump" and at the same time conceal the extent of the expansion of commercial demand as 1959 shipments exceed by a large margin those of the preceding year. 1/

17. A factor tending to aggravate the situation in 1957 and 1958 was the increase of Russian exports of aluminum at cut rate prices. Although the quantity was not great, the effect was considerable. The Canadians were most directly affected because of Russian shipments into the U.K. The Canadian appeal to the British government to impose anti-dumping provisions was rejected but an agreement reached between the U.K. and U.S.S.R. will limit Russian imports to 15,000 tons for the 12 months ending October 1959. This is about 4½% of present U.K. consumption and about 10% of Canadian exports to the U.K. in 1957 and 1958. Although U.S. producers were not directly affected by Russian exports, they used the Russian threat to bolster their appeals in 1958 for increased tariff protection. With the Russian agreement to limit export to the U.K. and the increasing evidence of recovery in the aluminum markets, concern over Russian actions in this field has lessened considerably.

18. In addition to the attempts to gain protection, the industry postponed or stretched out its plans for expansion and it cut the price of aluminum. In April 1958 the Aluminium Company of Canada (Alcan) reduced its price of primary aluminum by 2¢ to 22½¢ (U.S.) per pound. The American companies followed. 2/ In August the U.S. producers regained some of this cut when they increased prices by 7/10¢ per pound. Alcan followed in the U.S. market but not in other markets. Then in December 1958 prices of both ingot and semi-fabricated products in the U.S. market were frozen at present levels until July 1, 1959 by action of the producers themselves. 3/

1/ Some of this increase may be due to stockpiling in anticipation of a strike. Industry sources generally discount the importance of this factor.

2/ Actually a differential was maintained between the U.S. price and the Canadian export price to other markets equivalent to the U.S. Tariff and the exchange differential between U.S. and Canadian currencies - or 1.5¢ (U.S.).

3/ This action was initiated by the Canadians, who agreed to guarantee present prices of ingot on orders placed before January 1 and shipped before July 1, 1959. Reynolds promptly extended the same price protection to all aluminum products and then Alcoa went even further by dropping the requirement that orders had to be placed before January 1. Kaiser followed Alcoa and the entire industry conformed to the pattern set down by Alcoa & Kaiser.

19. A third reaction of producers to the present condition of surplus has been an apparent quickening of the pace of technical development and product promotion as producers seek to meet the challenge of idle capacity by developing new markets. On the basis of efforts along these lines, there are good prospects for considerable increases in aluminum consumption, particularly in the automobile, housing and canning industries, although the full impact of these developments may still be a few years away. However, with the general improvement in economic activity and the recovery of aluminum consumption underway in 1959, the prospects are good for a resumption of the high rates of growth that have characterized the industry in the past. The market prospects for the 1960's will be dealt with in the following section.

II. THE PROSPECTS FOR DEMAND

A. Characteristics of the Aluminum Market and the Problem of Anticipating Future Demand

20. Reference has already been made to the very rapid expansion that has characterized the aluminum market. This has been due to the inherent qualities and relative cost of the metal combined with its late start. It was introduced on a commercial scale only shortly before the turn of the century and since the mid-1900's when it accounted for less than 1% of the tonnage of all non-ferrous metals consumed in the world, it has grown at an average annual rate of 11% until today its share is about 27%, a position comparable to copper, the world's leading non-ferrous metal since the mid-1920's (see Figure II). However, in spite of this rapid growth, when the prospects for the further expansion of uses are considered it is clear that aluminum has not yet reached a position among the much older metals consistent with its particular qualities and relative cost. Accordingly its future growth can be expected to continue to be more rapid than the growth of non-ferrous metals in general. Although this is favorable to aluminum, it does pose a problem for estimating the future development of demand. If its use is not closely related to metal use in general, on what can estimates of future demand be based? Can they be based directly on past trends or can the development of the aluminum market be expected to follow some regular curve of growth with a gradual declining rate until aluminum reaches a stable position among metals at some future time? Neither approach is wholly satisfactory. The extrapolation of past trends is not a logical method for forecasting the demand for a rapidly growing "new product" and there is as yet no adequate basis for fitting expected demand to some regular growth curve. 1/

21. The problem of projecting aluminum demand arises from the difficulty of forecasting the development of new uses. The growth of aluminum consumption can be considered as consisting of two parts: that directly related to the expansion of established uses growing in step with the expansion of the economy and that consisting of new uses which are continually being developed as aluminum's inherent qualities and relative price are more fully exploited. If the pattern of growth of the economy can be anticipated the implied growth of aluminum consumption due solely to such expansion is relatively simple to estimate. The main problem is how to estimate the growth of new uses. In the past this type of growth has been an outstanding characteristic of the industry. 2/ There is no doubt

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1/ Although development of aluminum demand has many characteristics of the development of demand for a new good, because of the many separate markets involved its pattern of growth cannot be expected to follow a simple growth curve.

2/ Some rough calculations indicate that in the period 1952-56 when aluminum consumption was expanding at a rate of 11.5% in the U.S. a rate of 5% was attributable to the growth of the sectors consuming aluminum and the remainder 6.5% to the "development of new uses". Similarly for the OEEC countries in the period 1950-55 the overall rate was 12.5%, that attributable to economic growth of consuming sectors 7.5% and that to new uses, 5%.

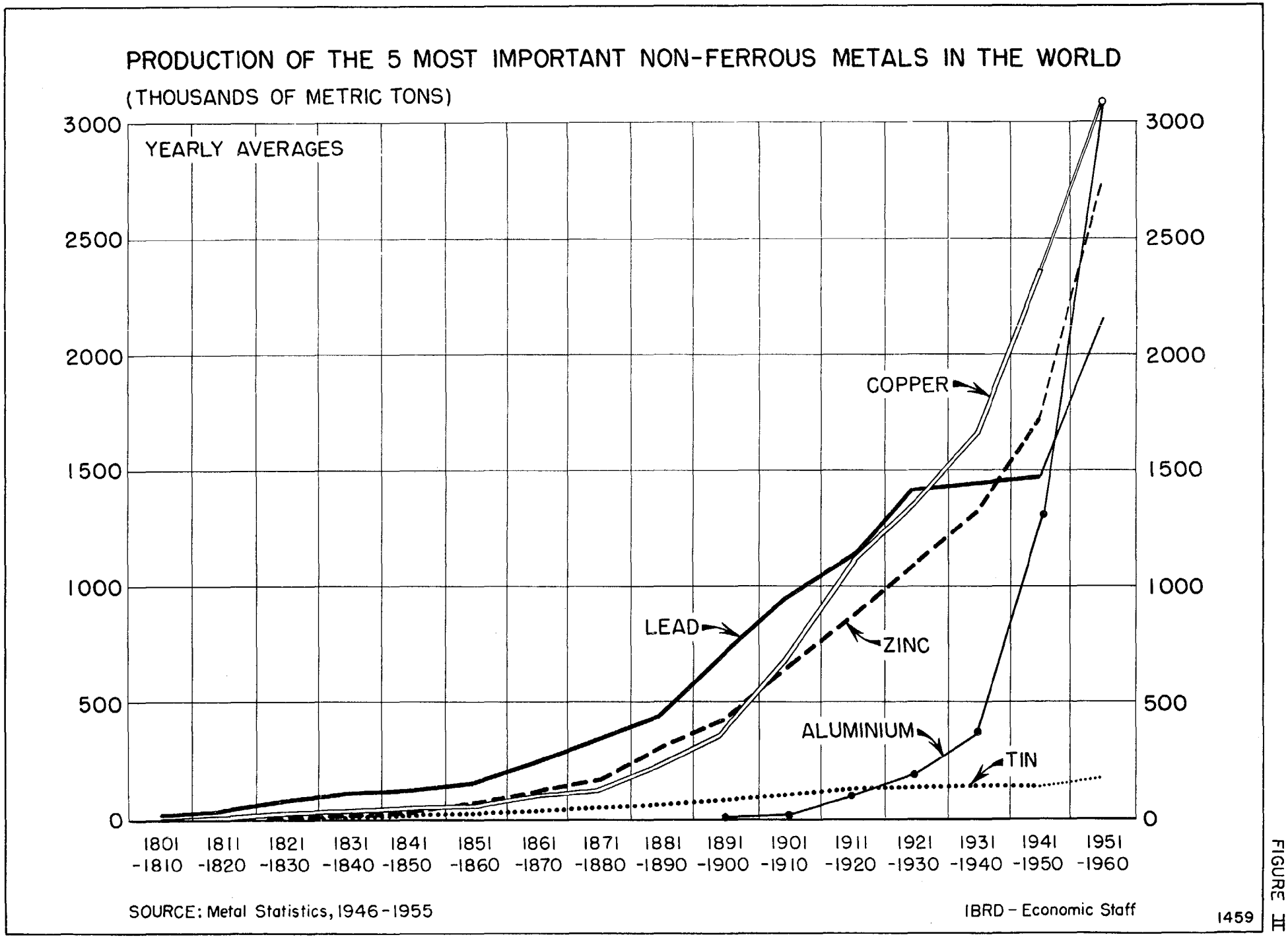
PRODUCTION OF THE 5 MOST IMPORTANT NON-FERROUS METALS IN THE WORLD
(THOUSANDS OF METRIC TONS)
YEARLY AVERAGES
3000
2500
2000
1500
1000
500
0
COPPER
LEAD
ZINC
ALUMINIUM
TIN
1801 -1810
1811 -1820
1821 -1830
1831 -1840
1841 -1850
1851 -1860
1861 -1870
1871 -1880
1881 -1890
1891 -1900
1901 -1910
1911 -1920
1921 -1930
1931 -1940
1941 -1950
1951 -1960
SOURCE: Metal Statistics, 1946-1955
IBRD - Economic Staff
1459

FIGURE II

that it has been related to the development of the technology of the metal and to the favorable development of its price relative to that of competing materials,1/ and to the effort given to its promotion. These factors would in turn appear to be related to the conditions of supply. This is illustrated by the experience following both World Wars. In each case wartime demand led to a great expansion of smelter capacity and a corresponding challenge to develop new markets for the metal when wartime needs ended. After each war the challenge was successfully met. The capacities created were quickly turned to new commercial applications. But as pointed out in the previous discussion of the post World War II developments, not only the volume of metal available but also the structure of the supplying industry would seem to have been an important factor in stimulating the growth of the market. The role played by the change in structure of the American industry brought about by the introduction of two new producers following World War II has already been mentioned.

22. The following estimates project demand to grow at slower rates than would simple extrapolations of past trends but at more rapid rates than could be expected to result simply from an expansion of the existing patterns of consumption in step with general economic growth. These projections involve an appreciable development of new uses. Although it is not possible to translate an evaluation of factors which may largely influence the effort devoted to the promotion of aluminum into an estimate of quantitative results, it is believed that the demand projections are generally consistent with the following assumptions insofar as the development of new uses is concerned. It is assumed that the U.S. aluminum industry will continue to maintain a fairly rapid development of new applications in spite of the already high level of consumption. This is due largely to the active promotion of new uses typical of the industry today and is related to the large volume of domestic production and the competitive relationship among the several producers. In the case of Europe, it is more difficult to anticipate the rate at which new applications will be developed. In spite of the great potential for growth arising from the very low level of present consumption, the fact that aluminum consumers must depend upon virtual national monopolies and imports for their supplies might be expected to inhibit to some extent the rapid growth of the market. This view is reflected in the demand estimates which assume that at least for the period 1956-65 European demand will grow at about the same rate as that of the U.S. Although this view seems to be justified on the basis of present conditions and immediate prospects, these could change and demand might well grow more rapidly as the result. In particular, a major change in the conditions of supply might have a stimulating effect on the market. It is conceivable, for example, that the participation of European producers in the development of production in Africa could result in stimulating the growth of the European market.

1/ The price of aluminum has been characterized by stability and a long run decline in real terms. Its price has also declined relative to that of its principal competitors, copper and steel. From the late 1930's to the present the decline in both real and relative terms has been considerable.

B. The Prospects for the U.S. Market

23. Although U.S. consumption was relatively stagnant from 1956 through 1958 by mid-1959 the renewed expansion of the market appeared to be well underway and the prospects are good for a continuation of the rapid growth that has characterized the industry in the past. The factors of strength in the U.S. market are the aggressive product development and selling efforts of the industry, as indicated by the actual development of new uses which may be expected to account for considerable tonnages in the near future, and the general prospect for continued expansion of the economy.

24. Aluminum consumption in the U.S. is concentrated in the fields of building, transportation, electrical lines and equipment, and consumer durables. Since some of these sectors tend to grow more rapidly than industry in general (in particular the transport and electrical sectors) that portion of aluminum consumption attributable to economic expansion tends to grow more rapidly than total industrial output. In the period 1952-56 the relative growth rates were 5% for aluminum and 3.5% for industrial output. For the period 1956-65 it is assumed that industrial output will grow at about the same rate 1/ and accordingly it may be expected that the present uses of aluminum will expand at a rate of about 5% per year. In addition it is clear that important new uses will also be developed in this period. In particular uses in automobiles, in building and in packaging are expected to increase far more rapidly than the output of the corresponding sectors.

25. The impending production of cars with aluminum engines added to the many other growing uses of aluminum in transmissions, grilles and trim, etc., is expected to increase the average use per car from the 1956 level of 35 pounds to a level of 100-120 pounds in 1965. In 1959 use had already increased to over 50 pounds. The industry is also anticipating a great increase of the use of aluminum in homes with the development of aluminum panels in addition to roofing, insulation, windows and screens. Canning is another field where aluminum use may also be greatly expanded. The tinplate industry is about as big as the entire aluminum industry and success of the present initial ventures into the canning field could result in a very large new use for aluminum. These are perhaps the more important examples of new uses being developed but they are not the only ones. With the prospects for very sizeable increase in use per unit of output in important fields of present consumption, it seems reasonable to attribute an additional 3% rate of growth to the development of new uses over and above the basic 5% related to economic expansion.2/ The resulting overall rate of 8% is somewhat lower than recent industry estimates 3/ but considerably above the rate of growth during the past 2 years. However, it now appears

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1/ World Economic Growth 1955-1962, Estimates Based on Existing Projections, IBRD, Economic Staff, December 1958.

2/ If use per unit in the transport sector (excluding aircraft), which accounts for about 15% of aluminum, should increase 2½ times this alone would increase the overall rate from 5% to over 6½%.

3/ Kaiser - 8½%; Reynolds - 10%.

that consumption in 1959 may make up most of the deficits of 1957 and 1958 and that growth from 1956 to 1959 may not be far below the 8% rate. For the period after 1965 it has been assumed that with many of the potential new markets already exploited, growth may slacken somewhat. A rate of 7% has been projected for the period 1965-70.

C. Prospects for the European Market

26. The factors of strength in the European market are the relatively low level of present consumption compared with the U.S. which, as already pointed out, could provide a basis for a considerable expansion of consumption, and the prospects for a fairly rapid pace of economic growth over the next 10 to 15 years. On the other hand, less aggressive promotion of aluminum arising from the differences in conditions of supply already mentioned, less familiarity with the uses of aluminum, and strong attachments for traditional ways and traditional materials are all factors that may tend to inhibit the expansion of the market. However, these retarding forces are important primarily in the short-run; their effects should tend to diminish as the market grows.

27. Available estimates of the expected rate of growth of European demand over the next 10 to 15 years range from under 7% upward to around 10%. Generally that part of the European market consisting of the 6 nations of the European Economic Community (Common Market) is expected to expand more rapidly than the U.K. market. This seems a reasonable expectation considering the much higher level of present consumption per capita in the U.K. and the fact that the prospects for general economic growth appear to be somewhat less favorable than in the case of the E.E.C. 1/ These two areas together account for 80% of the aluminum consumption in Europe.

28. The estimate used in this study is that the demand for aluminum in Europe as a whole will grow at an average annual rate of 8% for the period 1956-65. With what information is available this seems a reasonable estimate on the assumption that GNP will grow at an average rate of 3.3% per year during the period and industrial output at a rate of 4.5%. 2/ Along with an 8% growth for Europe as a whole, it is estimated that demand in the 6 Common Market countries will grow at a rate of 8.5%, that in the U.K. at a rate of 7% and that in the "rest of Europe" at 8%. After 1965 the rate of expansion is expected to increase. An overall rate of 8.5% is assumed for Europe as a whole for the period 1965-70 with corresponding increases for the various individual markets. The implications of these estimates in terms of consumption are shown in Table 4 along with estimates for North America developed in the preceding section and an estimate for the "rest of the world" which is assumed to grow at a rate of 10%.

1/ It is interesting to note that representatives of the E.E.C. are on record as considerably more optimistic in regard to the prospects for future demand for aluminum in the area (10%) than representatives of the nations exporting to the area (6-7%). GATT "Report of the Working Party on the Association of Overseas Territories with the European Economic Community, Report on Aluminum, Alumina and Bauxite", August 11, 1958.

2/ World Economic Growth, op.cit.

Table 4

Estimates of Future Demand for Primary Aluminum
(in thousands of metric tons)

	1956	1965	1970
United States	1610	3200	4500
Canada	85	155	220
Europe	850	1700	2600
United Kingdom	280	520	750
Common Market	420	880	1400
Rest of Europe	150	300	450
Rest of World	155	365	600
TOTAL	2700	5420	7920

Implied rates of growth for period 1956-65: 8% for U.S., Europe as a whole, and "Rest of Europe"; 8.5% for Common Market, 7% for United Kingdom and Canada and 10% for "Rest of World." For 1965-70: 7% for U.S., 8.5% for Europe, 10% for "Rest of World".

III. ESTIMATES OF FUTURE SUPPLY AND EUROPE'S GROWING NEED FOR IMPORTS

A. The Importance of Power in the Production of Aluminum

29. In the production of aluminum there are two main steps: the conversion of the ore (bauxite) to alumina (aluminum oxide), and the reduction of alumina to aluminum metal. The first step is a chemical process requiring fuel, the second is an electrolytic process, requiring large amounts of electric power. It takes roughly 4 tons of bauxite to produce 2 tons of alumina from which 1 ton of aluminum metal can be extracted. The economics of location for an alumina plant are governed mainly by transport considerations. Because of the weight lost in the process there is a trend toward the production of alumina near the source of bauxite, e.g. Jamaica, British Guiana and Guinea. In the case of an aluminum smelter location is governed mainly by the availability of large amounts of cheap electric power. It takes about 8 KWH to produce a pound of aluminum from alumina. This means that about 2.5-3 KW of power capacity are needed for each ton of annual capacity of aluminum. It also means that a variation in power costs of 1 mill per KWH represents a change in costs of production of almost 1 cent a pound, an important consideration with aluminum selling at 22.5-24 cents a pound.

30. The cost of transporting alumina to the smelter and crude aluminum to the market is also an important factor and may be decisive in determining the most economic location for a smelter in cases where the difference in cost of power at alternative sites is relatively small. This has been illustrated recently by the shift in the location of new smelters in the U.S. from the cheap hydro power of the northwest to the thermal power in the Ohio Valley where savings in transport costs were considered more than enough to compensate for the more expensive power. 1/ In this case the transport involved was overland, and therefore expensive; the differential in power costs was of the order of only 2 mills; and the Ohio Valley locations were not only close to rich coal deposits but also in the center of the major U.S. market for the metal.

B. The Future Supply of Aluminum

31. The great importance of large blocks of cheap power means that with few exceptions new smelters must be based on hydro power. Except in those cases where the full capacity of existing hydro developments is not at present being utilized as in the case of several of Alcan's plants, this involves the construction of new hydro facilities which generally takes a considerable time. A combined aluminum smelter and power plant

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1/ "The Geography of Aluminum Changes Again", Business Week, June 16, 1956.

may require 5 to 6 years from the time construction is started until aluminum is produced. In addition to the time required to bring in new capacity, the size of the plants and the unique requirements for cheap power limit the number of projects that are generally under serious consideration at any one time. For these reasons, it is possible to estimate the maximum future capacity for 5 to 6 years ahead with a considerable degree of assurance on the basis of announced plans. All the plans may not be carried out as scheduled and less aluminum may be produced than originally planned. But because of the limitations of time, the planned figure is unlikely to be exceeded. These observations refer to aluminum smelters based on hydroelectric power. In the case of smelters based on thermal electric power, the anticipation of future capacity is more difficult. In this case, new facilities may be brought into production in a much shorter time and company plans may give an indication of maximum capacity for only a very short period in the future. However, economic production based on thermal plants is generally confined to the U.S. where coal is cheap, where the consuming market is near the coal and where transport costs to and from the low-cost hydro sites in the northwest are appreciable. For the rest of the world hydro power may be expected to continue as the principal source of power for aluminum.

32. The best available estimates of future primary aluminum capacity are presented in Table 5 and in more detail in Appendix Table V. These figures represent in general the maximum capacity that can be expected to be reached by 1961 and, with the exception of the U.S. figure, by 1965. There may be some leeway in the 1961 figures, particularly in the case of the U.S. and Canada where previous expansion plans were stretched out as a result of the 1957-58 slump. More capacity probably could be added in both cases by 1961 if market developments should warrant it. However, the U.S. figure for 1965 is undoubtedly an underestimate for the reasons already mentioned. While the U.S. figure for 1965 is underestimated, the Canadian industry may not expand as rapidly as indicated. The Canadians produce primarily for export and the actual expansion undertaken will depend on how the prospects for aluminum exports develop. None of the proposed developments in Africa are included in Table 5 since it is assumed none of them will be in production by 1965. These and other possible projects for the period after 1965 are shown in Appendix Table VII. The African projects are discussed in Part IV.

C. The Future Balance of Capacity and Demand

33. The above estimates of future demand (Table 4) and future capacity (Table 5) are compared in Table 6. If it is borne in mind that capacity is generally in excess of "normal rates of production", it is seen that capacity will probably be about in balance with demand by 1961. Of the major markets the U.S. will be close to balance, with Europe's growing deficit and the deficit in the "rest of the world" balancing a good portion of Canada's surplus. Actually Canada can also be expected to continue to supply a portion of the U.S. market, as it has traditionally done, even if the U.S. capacity and demand should be in overall balance.

Table 5

Estimated World[1] Primary Aluminum Capacity in 1957, Planned Capacity for 1961 and Possible Capacity in 1965 based on Announced Plans for Expansion
(in thousands of metric tons)

COUNTRY	1957	1961	1965
U.S.A.	1674	2370	2566 [2]
Canada	740	865	1310 [4]
TOTAL NORTH AMERICA	2414	3235	3876
Austria	60	60	60
France & Cameroons [3]	170	275	285
Germany	163	163	163
Italy	63	67	77
Norway	108	176	272
Spain	12	38	40
Sweden	15	15	15
Switzerland	32	32	50
United Kingdom	28	32	32
Yugoslavia	22	40	40
TOTAL EUROPE	697	898	1034
Australia	10	10	10
Formosa	9	20	20
India	8	21	40
Japan	66	122	143
TOTAL AUSTRALIA AND ASIA	93	173	213
Brazil	4	23	55
Peru			9
Surinam	—	—	55
TOTAL SOUTH AMERICA	4	23	119
GRAND TOTAL	3208	4330	5242

1/ Excluding Soviet Sphere.
2/ An obvious underestimate due to absence of announced plans. Recent trend in U.S. to thermal based plants has probably influenced long-range plans by reducing time required to bring in new capacity.
3/ Includes 45,000-ton smelter at Edea in Cameroons which commenced production in late 1957.
4/ Power facilities constructed for expansion to 1,030,000 tons. Expansion to 1,310,000 tons depends on market conditions.

Table 6

Balance of Estimated Demand & Capacity
Primary Aluminum
(thousands of metric tons)

	1956	1957	1958	1959	1960	1961	1965
WORLD 1/							
Demand							
(a) trend line 2/	2700	2900	3100	3300	3700	3980	5450
(b) actual	2700	2500	2700				
Capacity 3/	2810	3210	3570*			4330	5240
Balance	+110	+710	+870			+350	- 210
U. S. A.							
Demand							
(a) trend line 2/	1610	1740	1860	2000	2200	2360	3200
(b) actual	1610	1600	1650	1900*			
Capacity 3/	1540	1670	2000			2370	2570
Balance	- 70	+ 70	+350			+ 10	- 630
Europe							
Demand							
(a) trend line 2/	850	920	990	1070	1150	1250	1700
(b) actual	850	835	850				
Capacity 3/	610	700	700*			900	1030
Balance	-240	-135	-150			-390	- 670
Canada							
Demand							
(a) trend line 2/	85	90	97	104	110	120	155
(b) actual	85	71	74				
Capacity 3/	565	740	770			865	1310
Balance	+480	+669	+696			+745	+1155
Rest of World							
Demand							
(a) trend line 2/	155	170	188	205	236	250	365
(b) actual	155	169	184				
Capacity 3/	95	100	100*			195	330
Balance	- 60	- 69	- 84			- 55	- 35

* estimated.
1/ Excluding Soviet Bloc.
2/ Trend line assuming uniform rates of growth based on projections in Table 4.
3/ Actual balance through 1958, difference between trend line and projected capacity thereafter. Capacity projections as in Table 5.

34. Between 1961 and 1965, as Table 6 indicates, expansion plans fail to keep up with the estimated growth of demand and by 1965 the result is a considerable deficit on a world basis. This is caused by the rapid development of deficits in Europe and the U.S. which are greater than Canada's growing export surplus. However, whereas the European deficit arises from a lack of a suitable economic basis for a large expansion of domestic aluminum production, the U.S. deficit is in part fictitious, being simply due to the lack of announced long-range plans. Nevertheless it does serve to highlight the fact that U.S. producers must either plan for a considerable expansion of domestic capacity in the early 1960's or an increase in imports from Canada. After 1965, and depending on how quickly construction is started, there is the additional alternative of obtaining supplies from foreign smelters in Africa or South America in which U.S. producers themselves participate. 1/ Although the potential for expanding domestic production may be sufficient to supply the bulk of domestic requirements for some time to come, it may be expected that the U.S. industry will, to an increasing extent, seek to supply its growing needs with metal from beyond its borders. The recent and growing interest of U.S. producers in foreign projects is some evidence of a movement in this direction. However, the full impact of such a shift may not be felt till the late 1960's. By that time the decisions of U.S. producers can be expected to have had an important effect on the pattern of aluminum trade.

35. In the following discussion, however, we are concerned mainly with the development of markets and capacity up to 1965. During this period it is assumed that U.S. domestic production is expanded to meet the major part of the U.S. requirements and attention is concentrated on the European import gap and the ways it may be filled. In this discussion the position of the Canadian industry is central and the U.S. market is involved mainly through the volume of its imports from Canada.

D. Europe's Growing Need for Imports

36. The probable pattern of development of Europe's need for imports is shown in some detail in Table 7. The estimates of demand and capacity for 1965 are as indicated in Table 6. Since there are no announced plans for capacity for the years beyond 1965, the estimates for 1970 are based on two arbitrary assumptions. It is assumed that production within the Common Market area will increase by only 45,000 tons because of the lack of sites for the economical production of aluminum and also because of the expected availability of supplies from abroad. The second assumption is that production in the "rest of Europe" will increase by 125,000 tons during this period. This could be expected to take place mainly in Norway, though there might also be some expansion in Austria and Yugoslavia.

37. As is evident from Table 7 not only will the U.K. continue to be a major and growing importer but the Common Market countries may also be

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1/ Reynolds and Kaiser are considering participation in African projects, Alcoa is constructing a smelter in Surinam. U.S. producers also participate in some Canadian production since Reynolds acquired a controlling interest in British Aluminium in 1959.

Table 7

European Import Requirements for Primary Aluminum in 1956 and Estimates for 1965 and 1970
(in thousands of metric tons)

	1956		1965		1970
Europe 1/					
Demand	850	1700		2600	
Supply	610	1030		1200	
Balance		-240	-670		-1400
United Kingdom					
Demand	280	520		750	
Supply	30	30		30	
Balance		-250	-490		- 720
Common Market					
Demand	420	880		1400	
Supply	360	525		570	
Balance		- 60	-355		- 830
Rest of Europe					
Demand	150	300		450	
Supply	220	475		600	
Balance		+ 70	+175		+ 150

1/ Excluding Soviet Sphere.
Source: - Tables 4, 5 and Appendix Table I (for estimates of supply in 1970 see text, Para.36).

expected to require substantial amounts of aluminum from abroad with a level of imports exceeding that of the U.K. by 1970. Although the "rest of Europe" will be producing a surplus of aluminum on the basis of Norway's large and expanding production, this will not be sufficient to prevent a great expansion in the import requirements for Europe as a whole. As Table 7 indicates these requirements are estimated to nearly triple between 1956 and 1965 and grow almost 6 times between 1956 and 1970. This represents an average rate of growth in import requirements of more than 13% per year.

38. These estimates are of course rough approximations and, like all estimates, are based on assumptions on varying value. In this case the underlying estimates of supply are firmer than those for demand. Although Europe's production might not reach the levels anticipated, it seems improbable that it would exceed these levels. On the other hand, if the use of aluminum should "catch on" in Europe under the stimulation of an assured adequate supply and the example of uses developed in North America, and accordingly, if the gap in levels of consumption between Europe and North America were to be narrowed, demand might grow more rapidly than anticipated. In specific terms, an increase in the average rate of expansion of the European market from 8 to 9% per year would increase the import requirements by 150,000 tons in 1965 assuming no change in the supply conditions. Whether such an increase would or would not take place is largely a matter of guesswork at this point. But in any event it is well to keep in mind that the quantities involved are large and rapidly growing. Under the assumptions of Table 7, the import requirements in 1965 are expanding at a rate of about 100,000 tons a year. In anticipating ways in which these requirements will be supplied, both their size and their rapid expansion must be kept in mind.

IV. FILLING THE GAP

39. There are several possible sources for Europe's growing requirements of aluminum. Canada is the principal one, at least until such time as African production may be developed. Canada is the traditional supplier of Europe's imports, which have been accounted for mainly by the U.K., and its position as a low cost producer with the capacity to rapidly expand production by a considerable amount make it a logical source of supply for European requirements. Nowhere else in the world can so much new capacity be brought in so quickly and at such low additional cost.

40. Another important source for the latter part of the 1960's is Africa. With great resources of bauxite and huge hydroelectric potential, Africa is bound to become an important source of aluminum in the near future. The fact that a number of proposed smelters lie within the Common Market area has made projects in Africa particularly attractive to European producers. Although there is little doubt that large aluminum smelters will be developed in Africa, the timing of these projects is as yet uncertain. Their execution requires the mobilization of large sums of capital and this task has not been made any easier by the present conditions of over-supply in the industry and the reduction in the Canadian export prices in 1958.

41. The U.S.S.R. is still another potential supplier of aluminum to Western Europe. The sharp increase in Russian exports to the West in 1957 raised considerable concern over the possibility of increased supplies from this source. Although U.S. exports to the U.K. were significant in 1958 and showed a sharp increase over previous years, this can be regarded as a temporary development associated with the general conditions of over-supply in the industry and the acquisition by a major U.S. producer (Reynolds) of interests in a major U.K. fabricator (Tube Investments).1/ It is not expected that the U.S. will become a supplier of aluminum to Europe. In the following sections the prospects for supply from Canada, Africa and U.S.S.R. will be considered in more detail and in relation to one another.

A. Aluminum from Canada

(i) Characteristics of the Canadian Industry:

42. Canada is reputed to be the world's lowest cost producer of aluminum ingot. Such evidence as is available appears to confirm that Canadian costs are below U.S. costs largely as a result of lower power costs. 2/ In addition to its favorable cost position, the Canadian industry

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1/ Subsequently Reynolds and Tube Investments acquired a controlling interest in British Aluminium which has a smelter in Canada. It is not expected that Reynolds will continue to ship American metal to the U.K. in preference to metal from British Aluminium's Canadian smelter.

2/ Financial analysts have estimated that the Aluminium Company of Canada may enjoy an advantage of 2-3 cents/pound in manufacturing costs over U.S. producers. Aluminum the Industry and the Four North American Producers, First Boston Corp., 1951; D.B. Macurda, "Aluminium Ltd.", F.S.Smithers & Co., Oct. 1958.

can expand its capacity quickly with relatively low additional investment. The industry's present capacity is 780,000 metric tons per year with Alcan accounting for 700,000, and British Aluminium, 80,000 tons. In addition, some of the investment has already been made for another 530,000 tons of capacity. Alcan has announced that when its present power projects are completed by the end of 1959, it will have the power basis to increase capacity by 210,000 tons for an average investment of about $500 per ton, roughly half the total cost of new capacity including power and smelter. 1/ This would bring the company's capacity up to 910,000 tons. The rest of the industry's potential increase, 320,000 tons, is accounted for largely by the possible further expansion of Alcan's Kitimat plant in British Columbia to its eventual capacity of 500,000 tons and the potential doubling of British Aluminium's smelter in Quebec. Neither of these expansions are being actively considered at the present time. In addition to the metal that could be produced from increased capacity, it should also be noted that the Canadian industry is at present 2/ operating at about 2/3rds of its existing capacity. In other words, at the present time about 250,000 tons more could be produced without additional investment.

43. The third essential fact about the Canadian industry is its position as the world's major exporter of primary aluminum. The industry exports roughly 85% of its output. Its principal markets are the U.K. and the U.S. In recent years it has supplied about 11% of U.S. requirements of primary aluminum and about 80% of U.K. requirements. Until the recent slump these two markets accounted for about 90% of Canadian aluminum exports. In 1957 and 1958 this proportion fell to 80% as unused capacity appeared in the U.S. and stiff competition developed from other producing countries for the slumping U.K. market. The remainder of Canadian exports are distributed widely around the world among many small and growing markets as indicated in Table 8 and, in more detail, in Appendix Table IV. The most important markets are in Europe and it is interesting to note that while shipments to the U.K. declined drastically in 1957 and 1958, shipments to the Continent, though still small, doubled in this period. In 1958 they accounted for 12% of Canadian exports with most of them going to the Common Market countries.

44. As an exporter of primary aluminum with relatively minor interests in fabricating plants abroad, the Canadian industry is vulnerable to general slumps in demand such as occurred in 1957 and 1958. In many markets it fills the gap between domestic production and total requirements and when conditions of over-supply occur it tends to suffer from the natural inclination of countries to reduce imports. In the U.S. where Alcan regularly supplied large amounts to integrated U.S. producers who required additional metal either to compensate for supplies they were obligated to

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1/ Address by Nathanael V. Davis, President, Aluminium Limited, to New York Society of Security Analysts, March 24, 1958.
2/ July 1959.

make available to independent fabricators 1/ or simply because finishing capacity exceeded ingot capacity, the impact was alleviated by the existence of long-term supply contracts with Kaiser and Alcoa. Under these contracts the U.S. companies were obligated to take Canadian aluminum even while their own plants were operating well below capacity. The Kaiser contract ran out in 1958 and the contract with Alcoa has been spread out so that in the first part of 1959 with the U.S. industry still running at less than full capacity, Canada's exports to the U.S. were sharply reduced. 2/ The general position was also reflected in a further reduction in the rate of Canadian operations in 1959 while production in the U.S. was increased considerably.

45. The Canadian experience in the recent slump was probably aggravated by the trend towards vertical integration in the U.S. industry which had been underway for several years. The Anaconda, Harvey and Ormet smelters which came into operation in the last two years with a combined capacity of about 230,000 tons all represent new primary capacity integrated with existing fabricators. There is no doubt that these developments have at least in the short-run adversely affected the market for Canadian metal in the U.S.

46. The belated Canadian reaction to slumping markets in general and the increased development of primary capacity in particular was to cut the price of aluminum which it did by 2¢ (to 22½¢ U.S.) in April 1958. This might be interpreted as a recognition that the previous price had been sufficiently high to encourage fabricators to erect their own smelters and place those who did not at some disadvantage when competing with integrated producers. However, its effect has been somewhat blunted in the U.S. by Alcan's reluctance to follow a hard competitive line in the face of demands by U.S. producers for increased tariff protection. 7/10th of a cent of the April cut was restored in August 1958 by U.S. companies with Alcan adjusting its prices accordingly. However, in markets outside the U.S. the Canadian price has remained at 22½¢ (U.S.) c.i.f. port of entry and as long as Canada has unused capacity and capacity for which part of the investment is already in place, and as long as there is the possibility that the development of new primary capacity elsewhere will prevent Canadian mills from reaching an economic level of production, there seems little chance that this price will be increased. Price is certainly one of the most important instruments the Canadians have in their struggle to regain their markets, round out their capacity and improve their economic position.

1/ 35% of government-aided primary aluminum expansion program covering the years 1950-55 must be made available to independent fabricators. For 1958 this worked out to be roughly 11% of the combined capacity of Alcoa, Kaiser and Reynolds - or about 195,000 tons.

2/ In the first 5 months of 1959 Canada's aluminum exports to the U.S. were about 2/3rds the level of the same period in 1958.

47. A second reaction of Alcan to recent developments has been an increased emphasis on the development of fabricating facilities by subsidiaries and affiliates abroad. In the case of the U.S. where Alcan has no subsidiaries, an example of this trend is the formation of a partnership with an important U.S. consumer operating in Canada. 1/

(ii) Prospects for Canadian Exports:

48. In spite of the present difficulties, with the renewed expansion of aluminum demand and the mobilization of idle capacity in the U.S. which are both already well underway, the prospects for the rapid recovery in volume of Canadian exports to its traditional markets appear good. In fact, it would seem reasonable to assume that by the mid-1960's Canadian exports will have substantially regained their former position in both the U.S. and U.K. markets. For purposes of illustration, assume that by 1965 Canadian metal supplies 75% of U.K. requirements and 10% of U.S. requirements of primary aluminum. These figures may be compared with 80% and 11% for recent past and would imply that Canadian exports to these areas grow at a slightly slower rate than that at which the market expands - or somewhat below the 8% and 7% rates assumed for the period 1956-1965. 2/

49. In the case of the U.K. the above estimate allows for a more rapid expansion of imports from other areas. In the case of the U.S. the figures imply that U.S. capacity must be expanded by some 300,000 tons more than is at present being planned. This may be a reasonable expectation because, as pointed out previously, U.S. thermal-based smelters do not require a long lead time. On the other hand, Canada's favorable cost position and the location of much of Canadian smelting capacity near the St. Lawrence and close to the heart of the U.S. market would seem to indicate that the estimate for U.S. use of Canadian metal is not overly optimistic.

50. In the case of Canada's exports to the Commonwealth countries and Latin America Canada's share of the market is generally large but the markets themselves are still very small. The Canadians are expecting a rapid expansion of exports going to these areas and indeed such a trend has been evident in recent years in spite of the slump in demand elsewhere. (See Table 8 and Appendix Table IV). In part the increased rate of expansion of these markets will tend to compensate for the reduced rate of growth anticipated for the U.K. market. To some extent the two developments are related as a significant part of the U.K.'s aluminum imports are re-exported in fabricated form to these same markets. With the rise of domestic

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1/ In June 1959 Aluminium Limited and Chrysler Corp. of Canada formed Chryslum, a jointly-owned subsidiary. The new company will lease Alcan's Beauharnois, Quebec, smelter (capacity, 35,000 tons) and supply all of Canadian Chrysler's needs plus some tonnage to Chrysler in Detroit. Aluminum shipped to the U.S. by Chryslum is to be sold at the U.S. price.
2/ Recent Canadian estimates of the growth of shipments to the U.S. and U.K. for the period 1955-65 are 7½ and 6% respectively. Mining and Mineral Processing in Canada, John Davis, Royal Commission on Canada's Economic Prospects, Ottawa, 1957.

Table 8

Shipments of Canadian Primary Aluminum
1956, 1957, 1958, and projections for 1965
(in thousands of metric tons)

	1956	1957	1958	I 1/ 1965	II 2/ 1965
North America					
Canada	83	75	73	155	155
United States	194	196	194	320	320
Europe					
United Kingdom	217	158	145	390)	435
Rest of Europe	27	44	53	280)	
British Commonwealth	9	11	21	40	40
Latin America	10	13	16	30	30
Other	6	13	10	20	20
Total	546	510	512	1235	1000

1/ Assuming Canada supplies 10% of U.S. requirements, 75% of U.K. requirements, doubles 1958 shipments to minor markets and fills the entire European deficit (670,000 tons).
2/ Assuming Canadian capacity expanded to 1,000,000 tons and that Canada supplies 10% of U.S. requirements, doubles shipments to minor markets and sells remainder of metal available for export in Europe. In this case Canadian shipments would be 235,000 tons short of meeting Europe's import requirements.

fabrication this pattern of trade will tend to be supplanted by direct shipments of primary aluminum from Canada. For purposes of illustration it is assumed that the markets for Canadian aluminum in the Commonwealth countries, Latin America and in other areas outside of North America and Europe will double in the period 1958-65. This implies an average rate of growth of about 11% per year.

51. If Canadian shipments to the U.S. and U.K. develop as assumed and if the newer markets in Latin America, Asia and Africa grow as expected, to what extent can the Canadian industry supply the increasing demands of Western Europe outside of the U.K.? To deal with this question two projections of the disposition of Canadian production in 1965 have been made as shown in Table 8. Projection I indicates that if Canadian capacity were to be expanded to a level of about 1,300,000 tons, which appears to represent rounding out present facilities to their maximum planned capacity, Canadian supplies would be just sufficient to meet European import requirements in 1965. However, in the face of a continuously expanding world market with European import requirements increasing at a rate of about 100,000 tons a year, this would cease to be true shortly thereafter.

52. Although under a reasonable set of assumptions Canada could conceivably supply European import requirements up to 1965, Canadian exports might not in fact reach the levels or the distribution assumed in Projection I. The markets might not develop as rapidly as anticipated; Canada's share of the U.S. market might be lower than expected or a portion of European requirements might be supplied from Africa and/or the U.S.S.R. However, even if developments fell short of those indicated in Projection I the Canadian industry would not necessarily be left with idle capacity. The industry is in a position to expand quickly on short notice and capacity can be expected to be increased in line with market prospects. Since an appreciable part of the investment is already in place for an expansion to about 1,000,000 tons it would seem that this level of operations would represent a minimum figure for Canadian production in 1965. Projection II in Table 8 indicates a possible distribution of exports with Canadian production at a level of 1,000,000 tons and assuming the same level of shipments to all markets except Europe. It will be noted that in this case Canadian supplies would fall short by 235,000 tons of filling Europe's assumed import requirements (670,000 tons). This could of course be partly made up by reduced Canadian shipments to other markets but in general it would seem to allow considerable leeway for any possible over-estimation of future markets on the one hand or the appearance of large supplies from Africa or the U.S.S.R. on the other. To summarize briefly, the Canadian industry appears to be in a good position to supply Europe's requirements up to about 1965 but able to adjust to conditions if requirements do not develop as quickly.

53. Little can be said at this time about the Canadian developments after 1965 when new supplies will be needed to meet growing world demand. Canada still has a great potential for expansion based on vast untapped hydroelectric resources which could be developed for the production of aluminum. Alcan has estimated these unused resources to be on the order of 20 million horsepower or roughly enough to produce 5,000,000 tons of aluminum. On the

other hand, new production from Africa appears in the offing and increasing supplies may be expected from this second potentially great exporting area in the late 1960's. It should be pointed out in this connection that Aluminium Ltd., Alcan's parent organization, has important interests in African bauxite. It has been mining bauxite in Guinea since 1952 and is planning to construct an alumina plant in the area. It is also involved in several of the groups studying smelter projects in Africa. As the industry grows and expands from continent to continent there is no doubt that further expansion in Canada will take into account the way developments in Africa progress as well as the manner in which world markets grow.

B. The African Projects

54. The attraction of Africa for the aluminum industry is based on the existence there of the world's largest reserves of high grade bauxite together with excellent sites for the generation of hydroelectric power. Bauxite is presently being exported from Ghana and Guinea. There are plans for greatly expanded operations in Guinea and an alumina plant is being constructed in that country at Fria. A small (45,000-ton) aluminum smelter is in operation in the Cameroons which can probably be expanded but major developments in aluminum smelting are still in the planning stage.

55. There are four major proposals under consideration to produce aluminum in Africa. Each is combined with a large hydroelectric development and in each case the combined power and aluminum investment is very large. Taken together these 4 proposed projects represent a combined smelting capacity of nearly 1,000,000 tons without taking into account the possibility of expansions in some cases beyond the initial stage.1/ Although some preliminary work is being done in connection with several of the projects, none are yet actively under construction and there are as yet no plans for construction sufficiently firm to provide a basis for estimating future output. Considering the time required to construct the dams, powerhouses, and smelters, etc. and considering the present state of the plans, it is highly unlikely that any quantity of aluminum will be produced from any of them before 1965 or 1966.

56. In each case a number of producers have been involved in the planning and study of the projected developments. Those so involved have included all the leading European, British, Canadian and American companies

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1/ Brief comments on each project are found in Appendix Table V. The planned capacities are as follows:

Inga (Belgian Congo)	450,000 tons
Konkouré (Guinea)	150,000
Kouilou (French Equatorial Africa - Middle Congo)	230,000
Volta (Ghana)	120,000
	950,000 tons

with the single exception of Alcoa. 1/ Some producers have interests in several projects. It is difficult to say at this time which project is most likely to be constructed first or what the order and timing of the successive developments might be. The final decisions depend on mobilizing industrial and financial support behind some particular scheme or schemes and this in turn depends in large degree on the market prospects for aluminum. However, the element of common involvement on the side of the producers, the large financial requirements, and the risks and uncertainties inherent in constructing large industrial enterprises in primitive and to some extent politically unstable environments will probably limit the number of projects that may be undertaken at one time, at least in the initial phases of development.

57. Although it may serve no useful purpose to try to anticipate investment decisions that will probably be made shortly, it is of interest to deal briefly with the market prospects for African production. As pointed out in the previous section, an expanded Canadian industry might be able to supply Europe's needs up to 1965. However, it was also emphasized that the Canadian industry was in a position to expand at short notice and so could adjust fairly rapidly to market conditions as they developed. As a consequence, if the market for Canadian metal should not grow as rapidly as anticipated this would not necessarily result in a condition of oversupply in Canada. On the assumption that the level of production for which considerable investment (in power) had already been made represents the minimum the Canadians intend to produce in 1965 (1,000,000 tons), there should be a sufficient market for new African production of 100-200,000 tons. After 1965 the market for African aluminum should increase rapidly.

58. For the period 1965-70 European import requirements are expected to increase by some 700,000 tons. At the same time it is anticipated that the U.S. industry will require 1,300,000 tons on top of its 1965 level of consumption. Even if the U.S. market should expand much less rapidly the requirements for this period may be expected to tax U.S. resources and the likely result is a shift in favor of imported metal. 2/ This could come mainly from Canada or Africa. If Canada supplied a large proportion of U.S. requirements, Canadian shipments to Europe might tend to be replaced by metal from Africa. On the other hand, the involvement of U.S. producers in Africa might lead to shipments of aluminum from Africa to the U.S. In any event it would appear that the need of both Europe and the U.S. to import aluminum could easily result in a market for African metal of 1,000,000 tons by 1970.

59. In the above discussion it has been assumed that the European import requirements will be supplied either by Canada or Africa. There is also the possibility of imports from the Soviet Bloc.

1/ Those involved in the various plans include: Pechiney-Ugine (France), AIAG (Switzerland), VAW (Germany), Montecatini (Italy), British Aluminium (U.K.), Aluminium Ltd. (Canada) and Reynolds and Kaiser (U.S.A.).
2/ See para. 34.

C. Aluminum from Russia?

(i) Recent Experience:

60. The fact that Russia cannot be ignored as a supplier of aluminum to Western Europe first became evident in 1957. In that year while the industry suffered from the general conditions of over-supply described earlier, greatly increased amounts of Russian metal appeared in the U.K. at prices appreciably below those for metal from Canada, the U.K.'s principal supplier. Although Russian shipments accounted for only 8% of the total U.K. imports of aluminum that year, their timing and their terms of sale aroused a considerable reaction. The Canadians applied for anti-dumping duties on the Russian metal and at the end of 1957 introduced "loyalty" discounts of 2% for their U.K. customers. U.S. producers, although not directly affected by Russian exports, were quick to recognize what they considered to be a threat to the "stability" of the industry. By late 1958 the situation was considerably less tense. The Russians agreed to limit sales in the U.K. for the next 12 months to 15,000 tons, their 1957 level of shipments. This made anti-dumping duties unnecessary and seemed to indicate that the Russians had no intention, at least for the present, of becoming a major aluminum exporter. In addition, Russian prices tended to move upward, closer to the Canadian level. For the entire year 1958 Russian sales in the U.K. declined to less than 12,000 tons and shipments for the first 4 months of 1959 have been running at about that rate.

61. The U.K. experience differs from that of Western Europe as a whole only in degree as indicated in Table 9. The figures shown differ from those just cited because they include shipments from Hungary, Poland and Czechoslovakia in addition to Russia's exports. Thus the total level of shipments from all Soviet Bloc countries has not amounted to more than 3% of European consumption and the volume of these shipments showed some decline in 1958. With the slowing down of Russian exports to Western Europe and the general recovery of aluminum markets there has been an increasing tendency to discount the possibility of large scale shipments from this source. A popular explanation of the increased shipments of 1957 is that they represent surplus aluminum which arose from a shift in the Russian military program from planes to missiles. Military uses have probably been absorbing the bulk of Russian aluminum output. However, this is considered to be a temporary surplus in view of the generally low level of aluminum consumption by other sectors. This view has received some support by a recent statement of a high Russian official claiming that the Soviet Union has a serious aluminum shortage which is likely to continue for a number of years and which should require increasing the plans for aluminum production.1/ He claimed that:

> "On account of the inadequacy of aluminum [the Soviet Union is] forced to limit its application in the electrical industry, in

1/ Mr. Averki B. Aristov, a Communist Party Presidium member at 21st Party Congress, February 1959. Reported in New York Times, February 9, 1959.

Table 9

European 1/ Imports of Aluminum from Soviet Bloc Countries
(in metric tons)

	1955	1956	1957	1958
Belgium-Luxembourg	-	6,910	5,890	5,530
Germany, Fed. Rep.	3,720	8,610	2,090	2,540
Netherlands	460	190	960	2,230
United Kingdom	2,520	940	17,360	14,270
Others	280	1,680	540	-
Total	6,980	18,330	26,840	24,570

1/ OEEC countries only.
Source: OEEC Foreign Trade Statistics.

machinery construction and also in other branches of the national economy. Consequently /the Soviet Union loses/ in a significant degree on such matters as the weight of machines, metal construction, the speeds of railroad, automobile and other kinds of transport, on the expenditure of fuel and suffer/s/ large losses."1/

62. It should of course be recognized that much of the reaction of Western producers to Russian exports in 1957 was not based on the fear that Russian shipments would take over a large part of the European market displacing traditional suppliers - but rather the fear that Russian tactics would force the price down. 2/ The prospect that such tactics might be repeated in the future depends on the condition of supply in the market and the size of Russian shipments. In times of over-supply there is always the chance that Russia may be able to disrupt the market to some extent by "dumping". However, in a rapidly expanding market these disruptions cannot be of a long duration and for the analysis of future market conditions the essential question is whether Russia may become a supplier of aluminum in substantial amounts - say over 100,000 tons - or remain, as at present, a marginal supplier. If it is expected that Russia may try to ship 100-200,000 tons a year to Western Europe by 1965 this would be a factor of significance in assessing the outlook for the other suppliers.

63. Whether in fact substantial Russian exports are to be expected is of course very difficult to determine. There is little relevant information available and accordingly the question can only be dealt with in an indirect way. If the Russians do plan to become a major exporter, it might be expected that this decision would be reflected in the production goals they have announced for 1965. It might also be expected that such a decision would make economic sense in terms of the quality and location of bauxite and power resources and the alternative fields in which exports might be developed.

(ii) Russian Plans for Expansion:

64. The Soviet Union publishes no figures of actual production. Such estimates as are available are constructed by adding successive planned increases to the few actual figures available for the immediate post-war period. It is not possible to check the extent to which planned goals have been met so that the farther the figures are extended, the greater the chance for error. Table 10 presents what appear to be the best data available on the level of Soviet production in the recent past together with an estimate of

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1/ Ibid.
2/ One U.S. producer has even gone so far as to blame the Russians for cutting the U.S. price: "Without selling a pound of aluminum in the United States, the Soviet was able to cut U.S. price by forcing Aluminium Limited to act /by selling aluminum more cheaply in the U.K. market/". World Trade in the Aluminum Industry, July 1958, Reynolds Metal Company.

Table 10

Tentative Estimates of Russian Primary Aluminum Production
(In thousands of metric tons)

Year	Production	Basis
1945	89	Shimkin 1/ - based on scattered facts author believes likely error 5%.
1950	180	4th 5-Year Plan called for doubling 1945 output. 2/
1955	500	5th 5-Year Plan called for production 2.6 times 1950 level announced that production reached 2.8 times level. 3/
1958	550	Assumed production at 90% of capacity reported by Revue de l'Aluminium. 4/
1965	1,550	7-Year Plan calls for production 2.8 times 1958. 5/

1/ D. B. Shimkin, Minerals a Key to Soviet Power, Harvard 1953.
2/ Reported in Shimkin - op. cit.
3/ Reported by T. Shabad, American Metal Market, Sept. 16, 1958, and F. Baer, Engineering & Mining Journal, May 1959. Original source apparently. Tass - April 24, 1956 Article 4 of chapter "Industry".
4/ Revue de l'Aluminium, Jan. 1959, (See Appendix Table VI).
5/ Targets of the 7-Year Plan for Soviet Economy 1959-1965, Theses of N.S. Khrushchev's Report to the 21st Congress of the C.P.S.U., Soviet Booklet #43, London, Dec. 1958. This is roughly 90% of 1965 capacity as estimated by Revue del'Aluminium, op. cit. (Appendix Table VI).

the goal planned for 1965. The figures for 1950 and 1955 are considered subject to error of as much as 20%. 1/ The estimate for 1958 is based on a study published in the Revue de l'Aluminium, January 1959, and the 1965 figure is 2.8 times larger in accordance with the production goal announced by Premier N. Khrushchev. 2/ The 1965 estimate is probably subject to more than 25% error in relation to the actual goal, which may in turn differ considerably from the level finally achieved.

65. The Russian plans call for a very rapid growth of aluminum (over 15% per year) and even making allowance for the approximate nature of the figures, the 1965 goal is going to be high by most standards. By comparison it is almost equivalent to present U.S. consumption. It would also be equivalent to the estimated consumption of the U.K. and the Common Market countries combined in 1965, or to almost one half the estimated U.S. consumption at that time. Is it likely that this quantity can be consumed by Russia and the countries of the Soviet Bloc?

66. In 1957 Russia exported over 50,000 tons of aluminum to other countries in the Soviet Bloc. This metal went mainly to Eastern Europe with less than 1,000 tons going to China, a potentially important market for the Russians. The volume of this trade might well be 100-200,000 tons by 1965, adding 50,000 tons to this as representing exports to Western Europe would leave 1,300,000 to 1,400,000 tons for Russia's own consumption. Considering the rapid economic growth projected for the Soviet Union, the low level of present aluminum use, and the indication that there may be a scarcity of copper and other metals for which aluminum might be substituted, there is no doubt that Russian consumption of aluminum can be expected to grow very rapidly if supplies are readily available. In view of the goals of the present 7-Year Plan it does not seem implausible for the Russian economy to be consuming 1,300,000 to 1,400,000 tons of aluminum by 1965. 3/ However, even if this level of consumption is achieved, it might well be that uses will not develop as rapidly as production and that fairly large surpluses may become available for export from time to time.

1/ T. Shabad in The Soviet Aluminum Industry, a study published by the American Metal Market, October 1958. Although figures shown in Appendix Table I are from a different source they are within this margin of error.
2/ Targets of the 7-Year Plan for Soviet Economy 1959-1965, Theses of N. S. Khrushchev's Report to the 21st Congress of the C.P.S.U., Soviet Booklet #43, London, December 1958. This is roughly 90% of 1965 capacity as estimated by Revue de l'Aluminium, January 1959.
3/ Allen Dulles, Director of the U.S. Central Intelligence Agency in his speech before Edison Electric Institute, April 8, 1959 (New York Times, April 9, 1959) estimated that whereas Russian industrial production was 40% of the U.S. level in 1956, by 1965 it is expected to reach 55% of the corresponding U.S. level. Russian consumption of 1,300,000 to 1,400,000 tons of aluminum in 1965 would be 40-45% of estimated U.S. consumption at that time.

(iii) Russia's Competitive Position:

67. Continuous and substantial Russian exports to Western Europe would only make sense if Russian resources of bauxite and power were of such quality and so located that the costs of producing and exporting aluminum were competitive in the long run in world markets. Exporting temporary surpluses that might appear due to planning errors, etc. is one thing and in such cases price may not be particularly important. But if the Russians are to become major exporters it seems only reasonable to assume that over the long run they must operate as other commercial suppliers do. The Russians must be able to sell for extended periods at world market prices. They must be able to meet the competition from Canada and Africa.

68. Very little is known concerning the competitive position of Russian aluminum production. However, it does appear to be based in large part on low grade bauxite with an increasing emphasis on substitute aluminum bearing materials; the transportation involved in assembling materials and delivering them to the markets appears to be high; and the major expansion in the industry is planned to take place in Siberia, many thousands of miles by rail from the markets of Western Europe. The location of the Russian plants seems particularly significant. (See Appendix Table VI). Of the estimated total capacity for 1965, 5% is located in the Leningrad area with easy access to western markets, 22% is near the Black or Caspian Seas in south western Russia, 13% is located in the Urals, far from the European border, and 60% is still further eastward in Siberia. 80% of the capacity being built or planned for construction between now and 1965 is to be located in Siberia. With the great bulk of Russian production a very long way from European centers of consumption, it is difficult to see how the Russians can be competitive over the long run with aluminum produced from the much richer ores of Africa and the Caribbean at points readily accessible to ocean transport.

69. In addition to the question of the cost position of the Russian industry, the question may also be asked as to whether the heavy investment required to produce aluminum would represent a sensible use of investment resources in order to earn foreign exchange. In this connection there are indications that the Russians have been shifting power sources from hydro to thermal plants in order to reduce investment outlays and obtain quicker results. It would seem to be questionable whether primary aluminum with its heavy investment requirements would be among the most suitable major Russian exports from the long run economic point of view.

70. The above arguments may be summarized as follows: Russia's plans for greatly increasing its aluminum industry do not necessarily imply the intention to become a major exporter of aluminum to the West. The information that is available about the location of the Russian industry and the quality of its raw materials would seem to support this view. Russian production for the European market would seem to operate under a number of disadvantages as compared with production in Canada or Africa. However, the rapid increase in consumption the Russians are attempting to achieve may be expected to generate surpluses from time to time and although shipments to the West might exceed 100,000 tons in some years, it is expected that in general they will be below this level.

D. A Probable Pattern of Development

71. On the basis of the above discussion it seems reasonable to expect Canada to be the principal supplier of European import requirements up to about 1965. African supplies may enter the European market at about this time or shortly thereafter. In the late 1960's African production may be expected to provide an increasing share of European requirements and there may be some shift of Canadian exports from Europe to the U.S. market. Russian shipments to Europe may be expected to fluctuate but in general they are not expected to exceed about 100,000 tons per year.

72. With the prospect of a rapid broadening of demand for aluminum there is bound to be a certain flexibility in the market. Periods of surplus capacity will tend to be short-lived and mistakes in the timing of new investment will tend to be minimized. As pointed out previously the estimates of demand may well be exceeded. It is difficult to predict the development of new uses. However, with a strong supply position and aggressive promotion of aluminum, European consumption in particular might grow more rapidly than expected and approach more closely the North American levels of consumption.

E. Price Considerations

73. The pattern of development described above involves an increase in world trade in aluminum. The Canadians dominate this trade today and most of the metal shipped between countries moves at the Canadian export price of 22½¢ (U.S.),1/ even though the price of aluminum in many domestic markets is appreciably higher. 2/ In an industry characterized by large producers administering stable prices, it can be expected that the Aluminium Company of Canada will continue to retain its position as "price leader" in the export field and that the price of aluminum will be largely determined by Alcan's price policy for some time to come.

74. As has already been pointed out (para. 46) there were good reasons for the price cut made by Alcan in 1958 and there are good reasons to expect that the company will not increase prices as long as this would tend to encourage the development of new capacity elsewhere which might hinder the Canadian mills from reaching full production. On another hand, it is possible that Alcan's cost position, which can only be improved by the rounding out of the present facilities, would allow some further reduction in price if that were considered to be in the company's best interests. Whether such

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1/ Canadian sales in the U.S. are an exception. In August 1958 the price of Canadian metal sold in this market was increased 7/10¢ when U.S. producers raised their prices by that amount. (See para. 46).
2/ For example, although the U.S. domestic price is 24.7¢ per pound for primary pig, recent U.S. exports of aluminum have been at the Canadian price of 22½¢.

action would result in more favorable market prospects is difficult to judge. In view of the recovery in world aluminum markets now underway, the delay in starting the African projects and the prospects for growing European import requirements in the next few years which cannot readily be supplied from other sources, the arguments for a further general price reduction do not appear to be particularly strong at this time. In the longer run, of course, the trend in the price of aluminum moving in international trade will be influenced by the cost conditions prevailing in the new producing areas whose output will be required to meet the growing demand for the metal.

APPENDIX A

Differences in the Aluminum Consumption, Europe and the U.S.

1. An important characteristic of the growth of world aluminum consumption since the 1930's has been the increasing disparity between the levels of consumption in the U.S. and in Europe. This disparity does not extend to metal consumption in general but is a characteristic of the greatly differing patterns of metal consumption in North America and in Europe. These differences can be illustrated in several ways. Table A-1 compares the growth in consumption of major metals in the U.K., France and Germany compared with the corresponding growth in the U.S. from 1938 to 1956. The lag in growth of European aluminum consumption is of course in part a reflection of the more rapid expansion of the U.S. economy during this period. However, the figures make clear the unique position of aluminum since no other metals show nearly the same extent of lag behind the growth of consumption in the U.S.

2. Tables A-2 and A-3 show the per capita levels of metal consumption in the U.S., U.K. and the Common Market countries for both pre-war and recent periods. The great differences in the pattern of metal consumption between the U.S. and the European countries are well brought out. The per capita consumption of copper, lead and zinc in some European countries exceeded that in the U.S. both before the war and, with the exception of lead, in 1956. In the case of aluminum, however, while U.S. consumption was below the European average in the late 1930's, in 1956 U.S. consumption was 2 to 3 times that of Germany, France and the U.K. and 6 to 7 times that of the Netherlands and Italy.

3. Table A-4 indicates the differences in the patterns of use of aluminum between the U.S. and Europe. The principal difference is seen to be in the much greater use of aluminum in the building industry in the U.S.

TABLE A-1

INDICES OF CONSUMPTION GROWTH
1938 - 1956

Growth of U.S. Consumption=100

	Steel	Aluminum	Copper	Zinc	Lead	Tin
United Kingdom	72	31	54	52	38	97
France	92	21	54	74	78	91
Germany	49	5	21	38	41	33

TABLE A-2

COMPARATIVE LEVELS OF METAL CONSUMPTION
UNITED STATES, UNITED KINGDOM AND COMMON MARKET
(In Pounds per Capita)

1935 - 1938

	STEEL	ALUMINUM	COPPER	ZINC	LEAD
United States	670	2.0	10.7	8.0	8.1
United Kingdom	470	2.1	12.4	10.2	15.9
Common Market	350	2.3	6.9	5.8	5.7
France	275	1.4	6.0	4.7	5.7
Germany	540	4.1	9.2	6.5	6.8
Belgium-Luxembourg	380	.8	7.7	26.6	11.8
Netherlands	255	.1	2.1	3.2	6.7
Italy	120	1.0	4.8	1.8	2.8

TABLE A-3

COMPARATIVE LEVELS OF METAL CONSUMPTION
UNITED STATES, UNITED KINGDOM AND COMMON MARKET
(In Pounds per Capita)

1956

	STEEL	ALUMINUM 1/	COPPER	ZINC	LEAD
United States	1330	25.6	15.0	11.7	13.9
United Kingdom	835	12.8	17.5	9.9	11.1
Common Market	610	7.1	7.8	7.4	5.9
France	625	8.1	8.3	7.7	6.1
Germany	936	10.5	9.5	9.5	7.7
Belgium-Luxembourg	651	4.0	16.4	22.7	10.3
Netherlands	521	3.5	4.5	4.3	8.4
Italy	264	4.2	4.8	2.8	2.5

1/ Primary and secondary.

TABLE A-4

U.S.A. & EUROPE
PATTERN OF ALUMINUM CONSUMPTION BY SECTORS

	Europe[1] (1955)		U.S.A. (1956)		Pounds per capita ratio of U.S. to Europe
	%	lbs. per capita	%	lbs. per capita	
Transport	24.0	1.5	19.3	4.1	2.7
Electricity	15.0	.93	12.8	2.7	2.9
Packaging	11.0	.68	5.1	1.1	1.6
Household Appliances	9.8	.61	15.9	3.4	5.6
Machinery	9.6	.60	11.4	2.4	4.0
Buildings	6.0	.37	22.7	4.8	13.0
Steel & Chemicals	5.0	.31	5.6	1.2	3.9
Other	19.6	1.2	7.2	1.5	1.25
TOTAL	100	6.2	100	21.3	3.4

1/ OEEC countries.

STATISTICAL APPENDIX

TABLE I

World Production of Primary Aluminum
(In thousands of metric tons)

	1938	1943	1950	1952	1954	1955	1956	1957	1958
United States	130	835	652	850	1325	1420	1523	1495	1425
Canada	65	450	360	453	509	551	653	506	545
Brazil	-	-	-	1	2	2	6	17	12
TOTAL AMERICA:	195	1285	1012	1304	1836	1973	2092	2018	1982
Germany	161 1/	204 1/	28	101	129	137	147	154	137
France	45	47	61	106	120	129	150	160	169
Italy	26	46	37	53	58	62	64	66	64
Austria	4	46	18	37	48	57	59	57	57
Norway	29	24	45	51	61	72	93	96	122
Spain	1	1	2	4	4	10	14	15	16
Sweden	2	4	4	8	11	10	13	14	14
Switzerland	27	19	19	27	26	30	30	31	32
United Kingdom	23	57	30	29	32	25	28	30	27
Yugoslavia	1	2	2	3	4	12	15	18	22
TOTAL EUROPE:	319	450	246	419	493	544	613	641	660
Formosa	5	15	2	4	7	7	9	8	9
India	-	1	4	4	5	7	7	8	8
Japan	18	108	25	43	53	58	66	68	85
TOTAL ASIA:	23	124	31	51	65	72	82	84	102
OCEANIA: Australia	-	-	-	-	-	1	9	11	11
AFRICA: Cameroons	-	-	-	-	-	-	-	8	32
TOTAL FREE WORLD:	537	1859	1289	1774	2394	2590	2796	2762	2787
U.S.S.R. 2/	50	62	209	230	360	400	430	530	550
East Germany	-	-	2	15	21	26	30	28	28
Czechoslovakia	-	-	-	-	3	25	21	18	18
Hungary	2	10	7	15	28	37	30	26	38
Poland	-	-	-	-	3	20	21	20	23
Roumania	-	-	-	-	-	6	10	10	10
North Korea	-	13	1	-	-	-	-	-	-
China (Manchuria)	1	9	-	-	-	-	5	10	30
TOTAL SOVIET SPHERE: 2/	53	94	219	260	415	514	547	620	697
GRAND TOTAL:	590	1953	1508	2034	2809	3104	3343	3404	3484

1/ Pre-war Germany - figures from 1950 on refer to West Germany.
2/ Estimates may be subject to considerable error from 1950 on (see text Part IV C and Table 11).
Sources: Metal Statistics, Metallgesellschaft A.G., Frankfurt. For 1958 figures: Year Book of the American Bureau of Metal Statistics, June 1959.

TABLE II

World Consumption of Primary Aluminum
(in thousands of metric tons)

	1938	1943	1950	1952	1954	1955	1956	1957	1958 1/
United States	81	796	823	966	1260	1582	1609	1608	1650
Canada	6	36	59	82	73	83	83	71	74
Brazil	-	-	7	7	17	9	19	20	20*
Mexico	-	-	3	2	5	8	8	10*	10*
Other America	1	3	13	4	16	14	16	15*	15*
TOTAL AMERICA:	88	835	905	1061	1371	1696	1735	1724	1769
Belg.-Lux.	2	1	5	13	17	26	33	27	41
Germany	173 2/	249 2/	50	92	133	174	173	186	190*
France	31	32	55	90	99	109	132	153	144
Italy	26	53	48	52	61	62	72	80	60
Netherlands	-	1	4	6	8	8	9	8	8*
Austria	-	-	6	16	26	34	36	34	34
Denmark	1	2	3	3	3	4	3	4	4*
Finland	-	-	1	2	1	3	2	2	2*
Norway	1	2	6	12	14	14	15	17	17
Spain	1	2	4	5	7	11	16	20	27
Sweden	7	7	14	23	22	30	28	29	32
Switzerland	12	10	12	28	27	35	37	38	30
United Kingdom	45	212	184	224	229	291	281	217	237
Yugoslavia	-	-	3	3	4	9	13	18*	18*
Other Europe	1	-	2	2	2	2	2	2*	2*
TOTAL EUROPE:	300	571	397	571	653	812	852	835	846
India	-	1	6	5	8	13	10	13	15
Japan	50	150	19	33	46	50	66	75	82
Other Asia	-	-	3	3	4	6	8	8	8*
TOTAL ASIA:	50	151	28	41	58	69	84	96	105
OCEANIA: Australia	-	4	6	9	11	17	20	20*	26*
Union of S. Africa	-	-	1	2	4	5	5	6*	6*
Other Africa	-	-	1	1	1	1	2	2*	2*
TOTAL AFRICA:	-	-	2	3	5	6	7	8*	8*
TOTAL FREE WORLD:	438	1561	1338	1685	2098	2600	2698	2481	2728

TABLE II

	1938	1943	1950	1952	1954	1955	1956	1957	1958
U. S. S. R.* 3/	57	110	215	225	380	410	440	480	
East Germany*	-	-	2	14	20	25	30	30	
Czechoslovakia*	4	2	14	15	18	20	20	20	
Hungary*	3	11	6	10	14	15	10	15	
Other East Europe*	1	1	2	3	3	5	5	5	
China*	2	-	2	3	3	5	5	10	
TOTAL SOVIET SPHERE:* 3/	67	124	241	270	438	480	510	560	
GRAND TOTAL:*	505	1685	1579	1955	2536	3080	3208	3041	

1/ Partial data from Year Book of the American Bureau of Metal Statistics, June 1959, adjusted in some cases to make figures consistent with previous series.
2/ Pre-war Germany and Austria - figures for 1950 on refer to West Germany.
3/ Estimates may be subject to considerable error.
* Estimates.
Source: Metal Statistics, Metallgesellschaft A.G., Frankfurt.

TABLE III

International Trade in Primary Aluminum

MAJOR EXPORTERS	NET EXPORTS (in thousands of metric tons)									
	1938	1950	1951	1952	1953	1954	1955	1956	1957	1958
Canada	59	305	322	374	417	425	460	462	432	428
Norway	29	39	40	34	46	45	61	79	72	108
Austria	1	14	7	11	26	21	25	24	23	32
France	14	16	7	5	38	15	21	6	12	21
Japan	-27	23	7	7	10	8	14	-	-9	4
NORTH AMERICA (Canada & U.S.)	55	145	212	259	146	234	304	297	255	244

MAJOR IMPORTERS	NET IMPORTS (in thousands of metric tons)									
EUROPE & NORTH AMERICA										
United Kingdom	46	138	178	239	170	190	259	226	184	212
United States	4	160	110	115	271	191	156	165	177	184
Benelux	2	10	20	19	18	25	34	42	35	48
Germany	11	5	9	1	-10	6	40	36	34	64
Sweden	5	8	11	15	15	13	18	20	16	18
Switzerland	-18	-7	3	2	- 5	1	5	7	5	-6
Italy	-	10	-3	-	5	-7	1	9	16	-4
EUROPE 1/ (as a whole)	-	95	160	228	81	150	251	237	194	184
COMMON MARKET	-	9	19	15	-25	9	54	80	73	87
BRITISH COMMONWEALTH										
Australia	..	6	9 2/	12 2/	6 2/	9 2/	13 2/	12 2/	10	
India	..	2	3	2	1	2	6	3	18	
South Africa	..	1	2	2	3	4	5	5	7	
LATIN AMERICA										
Argentina 3/	..	13	6	3	4	16	15	20	12	
Brazil	..	7	11	6	7	15	6	13	13	
Mexico	..	3	3	2	5	5	8	8	9	

1/ OEEC countries only.
2/ Years ended June 30.
3/ Includes sheet as well as ingots.
\- net position in balance. .. negligible

Sources: - Metal Statistics - Metallgesellschaft (basic source).
OEEC Statistical Bulletins (for 1957 & 1958).
U.K. - The Mineral Industry of the British Empire and Foreign Countries, Statistical Summary (for British Commonwealth and Latin America).

TABLE IV

Canadian Exports of Primary Aluminum
(in thousands of metric tons)

	1953	1954	1955	1956	1957	1958
United Kingdom	171.4	191.5	231.7	217.4	157.8	144.9
United States	211.8	180.1	175.7	193.5	196.2	194.0
	383.2	371.6	407.4	410.9	354.0	338.9
Europe						
Belgium	0.8	4.0	4.5	2.7	2.8	8.8
France	-	-	-	1.4	1.4	1.4
Germany	3.5	3.6	7.2	4.8	17.2	25.9
Italy	2.5	3.7	4.0	4.6	10.0	2.6
Netherlands	4.6	7.5	8.6	8.4	4.5	1.0
Spain	neg.	1.2	-	1.1	2.7	4.7
Sweden	4.4	neg.	0.8	0.6	3.2	4.3
Switzerland	2.2	5.3	2.6	3.0	2.1	2.2
	18.0	25.3	27.7	26.6	43.9	52.9
British Commonwealth						
Australia	4.0	6.9	10.0	4.6	6.8	14.6
South Africa	1.9	2.5	0.6	1.9	2.9	3.2
India	1.0	2.1	1.6	2.3	1.7	3.0
	6.9	11.5	12.2	8.8	11.4	20.8
Latin America						
Argentina	-	1.2	-	3.7	2.7	neg.
Brazil	2.7	4.9	1.5	1.8	5.1	5.5
Mexico	2.7	3.0	4.6	4.1	5.5	10.8
	5.4	9.1	6.1	9.6	13.3	16.3
Far East						
Hong Kong	0.4	0.6	1.2	1.0	1.5	2.3
Japan	neg.	1.2	-	1.1	4.6	neg.
	0.4	1.8	1.2	2.1	6.1	2.3
Rest of World	3.1	5.7	5.2	3.7	7.0	8.1
Total	417.0	425.0	459.8	461.7	435.7	439.3

Source: Dominion Bureau of Statistics.

TABLE V

Details of Estimated World 1/ Primary Aluminum Capacity in 1957, Capacity Planned for 1961, and Possible Capacity in 1965, Based on Announced Plans
(in thousands of metric tons)

	1957	1961	1965
NORTH AMERICA			
U. S. A.			
Alcoa			
Massena, N.Y.	102	135	135
Badin, N.C.	43	43	57
Alcoa, Tenn.	143	143	143
Point Comfort, Tex.	109	127	127
Vancouver, Wash.	88	88	88
Wenatchee, Wash.	99	99	120
Rockdale, Tex.	136	136	136
Evansville, Ind.	-	136	136
TOTAL:	720	907	942
Reynolds			
Listerhill, Ala.	71	176	270
Longview, Wash.	55	55	55
Jones Mills, Ark.	99	99	99
Troutdale, Ore.	83	83	83
Corpus Christi, Tex.	86	86	86
Arkadelphia, Ark.	50	50	50
Massena, N.Y.	-	91	91
TOTAL:	444	640	734
Kaiser			
Mead, Wash.	160	160	160
Tacoma, Wash.	37	37	37
Chalmette, La.	225	225	225
Ravenswood, W.Va.	33	132	200
TOTAL:	455	554	622
Anaconda			
Columbia Falls, Mont.	55	55	55

1/ Excluding Soviet sphere.

TABLE V

	1957	1961	1965
Harvey Machine Co.			
The Dalles, Ore.	-	50	49
Ormet Corporation			
Omal, Ohio	-	164	164
TOTAL U.S.A.	1674	2370	2566 1/
CANADA			
Alcan			
Arvida	330	330	330
Isle Maligne	105	105	120
Shawinigan Falls	65	65	65
Beauharnois	35	35	35
Kitimat	170	250	500
New Eastern Capacity	-	-	100
TOTAL:	700	785	1150
Baco			
Baie Comeau	40	80	160
TOTAL CANADA	740	865	1310 2/
TOTAL NORTH AMERICA	2414	3235	3876
EUROPE			
AUSTRIA			
AIAG, Lend	8	8	8
VAW, Ranshofen	52	52	52
TOTAL:	60	60	60
FRANCE AND CAMEROONS			
Pechiney	130	180	190
Ugine	30	50	50
Cameroons	10	45	45
TOTAL:	170	275	285

1/ An obvious underestimate due to absence of announced plans. Recent trend in U.S. to thermal based plants has probably influenced long-range plans by reducing time required to bring in new capacity.
2/ Power facilities constructed for expansion to 1,030,000 tons. Expansion to 1,310,000 tons depends on market conditions.

TABLE V

	1957	1961	1965
GERMANY (W)			
AIAG, Rheinfelden	43	43	43
VAW	120	120	120
TOTAL:	163	163	163
ITALY			
SAVA, Porto Marghera	23	23	23
SAI, Borgofranco	4	4	4
Montecatini	36	40	50
TOTAL:	63	67	77
NORWAY 1/			
Ardal og Sunndal			
Ardal	28	64	96
Sunndal	40	50	50
DNN			
Eydehavn	9	9	9
Tyssedal	17	17	17
Naco, Høyanger	14	14	14
Mosjoen	-	22	88
TOTAL:	108	176	272
SPAIN			
Aluminio Expanol	2	13	15
Empresa Nacional del Aluminio (Endasa)	10	25	25
TOTAL:	12	38	40
SWEDEN			
Svenska Al. Kampaniet	15	15	15
SWITZERLAND			
AIAG			
Chippis	28	28	28
Steg	-	-	18
Aluminiumfabrik Martigny	4	4	4
TOTAL:	32	32	50

1/ Capacity shown for 1961 planned for 1959 - Sunndal expansion completed in 1958.

TABLE V

	1957	1961	1965
UNITED KINGDOM			
British Aluminium Company	32	32	32
YUGOSLAVIA			
Lozovac	5	5	5
Kidricevo, Strnisce	15	30	30
Razine, Sibenik	2	5	5
TOTAL:	22	40	40 1/
TOTAL EUROPE	697	898	1034
ASIA AND AUSTRALIA			
AUSTRALIA	10	10	10
FORMOSA	9	20	20
INDIA			
Indaluco	5	16	26
Aluminium Corporation	3	5	14
TOTAL:	8	21	40
JAPAN			
NKK	32	53	74
Showa Denko	20	40	40
Sumitomo Kagaku	14	29	29
TOTAL:	66	122	143
TOTAL ASIA AND AUSTRALIA	93	173	213
LATIN AMERICA			
BRAZIL			
Elquisa, Ouro Preto	2	9	9
Cia Brasileira de Aluminio (CBA)	2	14	46
TOTAL:	4	23	55

1/ Excludes 55,000-ton project to be financed by Russians - Russian assistance withdrawn in Spring 1958. It is assumed here that the project will not be realized before 1965.

TABLE V

	1957	1961	1965
PERU			
Cerro de Pasco - Montaro River			9
SURINAM			
Brokopondo			55
TOTAL LATIN AMERICA:	4	23	119
GRAND TOTAL:	3208	4330	5242

TABLE VI

U.S.S.R.
Estimates of Primary Aluminum Capacity in 1958,
Capacity under Construction, and Planned Capacity for 1965
(In thousands of metric tons)

Plant	Estimated Capacity 1958	Planned or under Construction	Estimated Capacity Planned for 1965
I. European Russia			
Northwest - Leningrad Area			
Based on local deposits of low grade bauxite and nephelite.			
Kandalakska (1954-5)	25	-	25
Nadvoitsy (1955)	20	-	20
Volkhov (1932)	45	-	45
Southwest - Ukraine and Transcaucasia			
Based on bauxite and alumina shipped from Urals - 1500-2000 miles away and to some extent on bauxite from Hungary. Plans to develop deposits of alunite and nephelite in area.			
Sumgait (1955)	30	20	50
Stalingrad	-	200	200
Yerevan (1950)	40	-	40
Zaporozhye (1933-reconstr.1949)	100	-	100
Total European Russia	260	220	480
II. Urals			
Based on local deposits of bauxite. Large shipments of bauxite and alumina from this area to plants in other parts of Russia.			
Kamensk (1939)	120	-	120
Krasnoturinsk (1945)	120	-	120
Total Urals	240	-	240
III. Siberia and Kazakhstan			
Based on alumina from the Urals, (Stalinsk). Bauxite 650 miles from site of Pavlodar alumina and aluminum plant, plans to develop deposits of nephelite (Krasnoyarsk), and sillimanite (Irkutsk).			
Irkutsk	-	300	300
Krasnoyarsk	-	400	400
Pavlodar	-	250	250
Stalinsk	100	-	100
Total Siberia and Kazakhstan	100	950	1,050
TOTAL U.S.S.R.	600	1,170	1,770

Source: Revue de l'Aluminium, January 1959 and 3 Articles by T. Shabad, American Metal Market, Sept. 12, 13, & 16, 1958.

TABLE VII

Projects at Various Stages of Planning and Development That Might Materialize after 1965 Primary Aluminum Capacity
(in thousands of metric tons)

AFRICA

Angola

In August 1958 French producer, Pechiney, reached agreement with Aluminio Portugues (Angola) SARL to construct smelter in this Portuguese territory. No construction schedule announced.

1st stage	25
Full capacity	50

Belgian Congo

Inga Project - Belgian Aluminium Syndicate, British Aluminium Company, Pechiney-Ugine, AIAG (Swiss), VAW (German), Montecatini, Reynolds and Aluminium Limited associated in Aluminga Syndicate to study possibilities for constructing smelter. Bauxite deposits have recently been discovered in the Congo.

Capacity	450

Cameroons

Edea - 45,000-ton smelter now in operation. Capacity could probably be doubled, although there are no announced plans for such an expansion. 45

French Equatorial Africa - Middle Congo

Kouilou project, originally considered by the French as an alternative or second stage to Konkouré, may be expected to assume a higher priority as result of Guinea's changed status. To use bauxite from Guinea.

Capacity	230

Ghana

Project on Volta River under study for some time. Surveyed by Kaiser engineers in 1958 who recommended constructing project to produce 120,000 tons instead of the 210,000 tons originally considered. Plans calls for a 4-stage program requiring more than 5 years. Local bauxite deposits. 120

TABLE VII (Cont'd)

Guinea

Konkouré project, large local bauxite deposits, originally planned for construction by mid-1960's by international group (France, Canada, Germany, U.S.A., U.K. and Switzerland). Plans postponed following Guinea's withdrawal from French Union.

Capacity	150
(Potential capacity	230)

AUSTRALIA

Australia

Plans being made to develop Queensland bauxite (200-million tons economic grade) on Cape York Peninsula. Commonwealth Aluminium Co. (Consolidated Zinc and British Aluminium) planning 500,000-ton alumina plant and 250,000-ton aluminum smelter. No decision made as between using New Guinea hydro power (245 miles from plant) or thermal power from open cut Blair Athol coal field. Plans very tentative. 250

LATIN AMERICA

Venezuela

The Venezuelan Development Corp. has budgeted $1.5 million to spend on preliminary plans for a 25,000-ton smelter in connection with the Caroni River Hydro scheme. Smelter to be expanded later to 50,000 tons. Timing indefinite. 50