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INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT

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APPRAISAL OF  
THE COMPANIA CARBONIFERA E INDUSTRIAL DE LOTA  
COAL MINE MODERNIZATION PROJECT

CHILE

July 9, 1957

Department of Technical Operations

**FILE COPY**

CURRENCY EQUIVALENTS

\$1	650 pesos
Pesos 1 million	\$1,538.46

All tons are metric tons

The Company's fiscal year ends  
Decmeber 31.

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APPRAISAL OF  
COMPANIA CARBONIFERA E INDUSTRIAL DE LOTA  
COAL MINE MODERNIZATION AND EXPANSION PROJECT  
CHILE  
SUMMARY AND CONCLUSIONS

- A. The Compania Carbonifera e Industrial de Lota, which owns and operates the largest coal mine in Chile (see map, Annex 1), has asked the Bank for a loan to meet the foreign exchange cost of an investment program designed to complete the modernization and expansion of its mine. The Chilean Government would guarantee the proposed loan, and the Corporacion de Fomento (CORFO) would be a co-borrower.
- B. The project involves the development of a new shaft mine, and the modernisation of the haulage and surface installations. The present working faces are very scattered; in future they will be much more concentrated, thus reducing the complexity and cost of underground transport. The project has been investigated on behalf of the Bank by Powell Duffryn Technical Services, Ltd., consultants.
- C. The project is soundly conceived from an engineering point of view. Its main effect should be to reduce costs of production. It should also result in some increase in annual output capacity (from the present level of about 1,000,000 tons to about 1,100,000 tons). Output could eventually be increased further by about 25% if conditions justified it. The proved reserves are adequate to support the planned rate of output until 1970, by which time further reserves, at present in the "indicated" category, will have been proved.
- D. The Company is well managed, but its technical staff needs strengthening and some reorganization. Labor relations are good, and the supply of labor is adequate. However, there is need of more supervisors (foremen, etc.) underground.
- E. The Company has no long term debt, and its current position is satisfactory. The company's earning power has shown a tendency to decline during the last few years, partly because of rising costs due to inflation which were not promptly matched by increases in Government controlled prices. Depreciation allowances have not always been adequate. Since selling prices were freed from control in July 1956, there has been an improvement in the profit margin on coal sales.
- F. To carry out its investment program, the company will have to spend about \$14 million equivalent between now and the end of 1962. Of this total, about \$6 million equivalent would be needed in local currency and about \$8 million equivalent in foreign exchange. With interest during construction, the total foreign exchange requirement will be \$9.6 million equivalent.

## II

G. The market should be able to absorb Lota's increased output (as well as that of the other Chilean coal mines) without prices falling to an unremunerative level. It is the policy of the Government to ensure a market for the planned output of the industry.

H. The project is justified from an economic point of view because of the foreign exchange savings on imported fuels, the prevention of unemployment which would result from declining production and ultimate closing of the mine, and the guarantee of a strategic minimum supply of fuel from domestic resources. These advantages outweigh the economic cost of having to afford the industry some degree of protection against the competition of imported fuel oil.

I. The company proposes to borrow the amount of foreign exchange required for the project (\$9.6 million equivalent, including interest during construction) from the Bank. It plans to meet most of its local currency requirements from funds generated by its operations. The balance, presently estimated at about \$2.8 million equivalent, it expects to borrow from CORFO.

J. Since local currency expenditures may exceed the estimates because of continued inflation, the proposed loan from CORFO would not be limited to a specified amount, but would cover any amount by which the Company's financial resources fall short of its needs for the project.

K. Conservative forecasts show that the Company's financial situation at the end of 1962 would be satisfactory, with a ratio of long-term debt to equity of 46:54. Total debt service would be covered at least 2.7 times in the following years. Even if sales in 1963 fell 20% below the assumed level debt service would be covered about twice over.

L. The project is a suitable basis for a Bank loan of \$9.6 million equivalent (including interest during construction). A term of 15 years (including a 5½ years grace period) would be appropriate.

M. If a Bank loan is made, the contractual arrangements should include appropriate limitations on the company's freedom to incur additional debt and to pay cash dividends (see para. below). The company should also undertake to strengthen its technical and supervisory staff, to carry out adequate mine development work, and to follow realistic depreciation and depletion policies.

N. It should be a condition of effectiveness of a Bank loan that satisfactory arrangements have been made with CORFO for local currency financing.

APPRAISAL OF THE  
COMPANIA CARBONIFERA E  
INDUSTRIAL DE LOTA  
MODERNIZATION PROJECT

I. INTRODUCTION

1. The Bank was first approached in 1949 about financing the Lota Company project for the concentration, expansion, and modernization of its coal mine, and this project was investigated for the Bank in 1950 and 1952 by J.W. Woomer and Associates of Wheeling, W.Va. The consultant's report was favorable, but further consideration of the project was suspended in 1952 pending settlement of certain matters between the Chilean Government and the Bank. When, in 1953, these other questions had been settled, Chile's financial position had deteriorated. It was not until June 15, 1956 that the Bank could inform the Chilean Government that it was prepared to resume lending operations in Chile, and in this connection would be willing to reconsider the Lota coal project.

2. In June 1956, the Bank engaged the British firm of Powell Duffryn Technical Services Limited for a reappraisal of the Lota project from a technical and financial point of view. This report which was submitted in November 1956 forms the basis for much of the following analysis.

II. THE COMPANY

History and Present Operations

3. The original Lota Company was formed in 1852. There have been several reorganisations; the present company (Compania Carbonifera e Industrial de Lota) dates from 1933. During the past 105 years several mines were operated; at present all activities are concentrated at one drift (inclined shaft) mine and three vertical shaft mines at Lota, on the Bay of Arauco, about 300 miles south of Valparaiso (See Annex 1, Map of Central Chile).

4. One of these mines (Piques Carlos Cousino) is a new mine which was started in 1936 with the sinking of two shafts to a depth of 530 metres and the driving of two main galleries of about 5.5 km each. This initial construction was halted in 1942, and further development was postponed due to lack of funds. In 1949, the company approached the Bank with a view to financing certain equipment for this mine, including hoisting and haulage equipment.

5. Rather than financing only a portion of the company's investment program, the Bank suggested that the company should submit an integrated program of development and investment for their total coal mining operations. Such a program was prepared making the Piques Carlos Cousino the nucleus of the company's mining operations by connecting it with the other two shaft mines. In connection with this concentration of output, haulage and coal preparation facilities would be modernized. The completion of this general scheme forms the basis for the company's present loan application.

6. During the last six years, the company's output has been remarkably steady at about one million tons per year (approximately 3,600 tons per work-day). The labor force at May 31, 1957 totalled about 8,000 workers in the mines and other departments plus about 610 salaried employees. Of the workers, about 5,500 are employed underground and on the surface of the mine (excluding workshops, preparation plant, administration, etc.). These figures refer to the total number of workers under contract; actually about 1,000 of the above 5,500 workers were absent due to illness, accidents, leave, etc., and were drawing only welfare allowances but no regular pay. The output per man-shift underground is about 0.74 tons.<sup>1/</sup> The present haulage arrangements from the very scattered workings as well as the surface handling arrangements are complicated and largely outmoded, which has an adverse effect upon productivity. The Chiflon Carlos drift mine has its own small screening plant. The coal from the other mines is screened at a central screening plant near Piques Carlos Cousino. Part of the undersize (less than 3/4") "slack" coal (about 500 tons per day out of 1,500 tons) is washed in a Baum jig with a maximum capacity of about 650 tons per day. All these washed slacks are sold to the Chilean Steel Company. About 16,000 tons per year of the unwashed slacks are used to produce electric power in the company's own 20-year-old station. Although the cost is high, this is justified by the possibility of covering peak requirements, for which there is a substantial surcharge when purchased power is used. At the present moment, this power station also serves as an outlet for some of the existing surplus of unwashed slacks. Approximately 25% of the coal is dispatched by rail and the remaining 75% by sea. Most of the latter is transported by Compania Naviera Arauco, an associated company. There is substantial downgrading of the screened coal from breakage in the handling between screening plant, storage bunkers and freight cars or vessel.

#### Special Risks

7. Because of the dispersion of the workings, ventilation is difficult, and since 1941 there have been three major explosions (1947, 1950, and 1951). On the other hand, the seams are not liable to spontaneous combustion. According to the consultant's report, there is an excessive number of silicosis and anthracosis cases, a problem which could increase in severity in the future because of the proposed concentration of workings. Following the consultant's recommendations, the company's safety department has already introduced several measures to keep the dust problem under control. There was considerable damage to surface installations in the 1939 earthquake, but new buildings would appear to be built to reasonable safety standards in this respect.

#### Ownership and Management

8. The ownership of the company is widely distributed. As of December 31, 1956, only slightly above one million of the company's 7.5 million shares

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<sup>1/</sup> This compares with an output per man-shift varying from 1.55 to 1.8 tons in the United Kingdom and the European Coal and Steel Community (except for Belgium where the figure is only 1.15 tons due to particularly difficult mining conditions). (January, 1957 figures.)



were owned by persons holding more than 50,000 shares each. The company's shares are quoted at the Santiago and Valparaiso stock exchanges. They were recently quoted at about 180 pesos as compared with a par value of 200 pesos.

9. Lota's management is competent and progressive. Nevertheless, there is an urgent need for an additional senior man to assist the present Chief Mining Engineer, and for the establishment of a separate Planning Department under a competent senior engineer. In addition to these two positions, the consultants recommend the hiring of additional engineers to ease the load on top management.

#### Labor

10. The supply of labor is adequate. Strikes occur occasionally, particularly at the time of the annual wage negotiations, but the latest one in 1954 which lasted 18 days was the longest in recent years. Lota's management is alive to the importance of good labor relations. Only about one-fifth of the workers are paid by piece rates, a much smaller proportion than at Schwager, due partly to the complicated and extensive haulage required for the four separate mines.

#### Associated Activities

11. Until recently, Lota also operated the Concepcion - Curanilahue railroad, a fleet of coal vessels, a refractory brick plant, and certain forest and agricultural activities. The railroad was ceded to the Chilean Government in 1956. The other activities had previously been organized as independent companies, and the shares distributed to Lota's shareholders except for small portions retained by the company.

#### Earnings Record and Financial Position

12. Financial data for the Lota company as of December 31, 1956 are given below. More detailed balance sheets, and earnings and cash-flow statements may be found in Annexes 2A, 2B, and 2C.

Summary Balance Sheet as of  
December 31, 1956  
(million pesos)

<u>Assets</u>		<u>Liabilities and Equity</u>	
Current Assets	2,912	Liabilities (mainly current)	1,869
Bonds, Shares, and Sundry Assets	686	Various Provisions	634
		Revaluation Reserves	1,921
Fixed Assets	3,220	Capital and Earned Surplus	2,020
Minus depreciation	<u>373</u>		
	<u>2,847</u>		
Total Assets	<u>6,445</u>	Total Liabilities & Equity	<u>6,445</u>

13. The persistent inflation in Chile makes it particularly difficult to appraise the company's recent earnings record and financial position, and the following analysis can only provide an approximate picture.

14. The fixed assets of the company have been revalued several times to bring them into line with current replacement costs; the most recent revaluation was made as of December 31, 1955. In view of the depreciation of the peso since that time, an up-to-date value of fixed assets would be about twice the current book value. About 60% of the revaluation reserves arise from the revaluation of fixed assets. The remainder corresponds to price increases for bonds and shares and for inventories, which are both valued in the balance sheet at about current market values.

15. Recent trends in production and profits are shown below. Profits are expressed both in the original pesos and in sterling-- the latter to facilitate a comparison over time as well as a comparison with the Schwager Company, whose accounts are kept in sterling. The principles followed for inventory valuation have not been very consistent. (See Remarks under Annex 2 A). Nevertheless, over the period as a whole, book gains on inventories other than coal are probably unimportant, and book gains on coal inventories relatively moderate.

Output of Coal and Profits after Income Taxes

		<u>Profits after Income Taxes</u>		
	<u>Output</u> ( <sup>'000</sup> Tons)	<u>Million</u> <u>pesos</u>	<u>% of</u> <u>equity</u> <sup>1/</sup>	<sup>'000</sup> <u>£ Sterling</u> <sup>2/</sup> <u>Equiv.</u>
1951	1,007	98	(10.5)	--
1952	1,083	125	9.3	439
1953	1,008	142	7.5	409
1954	974	172	(8.0)	376
1955	1,004	217	6.3	310
1956	960	282	(6.1)	251

<sup>1/</sup> Percentages within brackets are misleadingly high since in those years there was no revaluation of fixed assets in spite of very substantial inflation.

<sup>2/</sup> Approximation arrived at by taking the average of the sterling rate at the beginning and the rate at the end of each year.

16. The profits for 1956 were adversely affected by substantial operating losses on the Concepcion - Curanilahue railroad and by book losses in connection with the transfer of this railroad to the Chilean Government (altogether 243 million pesos). On the other hand, depreciation allowances

based on December 31, 1955 prices (103 million pesos) were only approximately one-half of the amounts required according to replacement values. Profits after taxes and after depreciation according to replacement values but before extraordinary losses were about £370,000 equivalent in 1956 compared with £310,000 equivalent in 1955.

17. In order to obtain an approximate idea of changes in the company's real earning power, allowing both for changes in the value of the currency and for differences in the annual allowances for depreciation and in pre-profit reservations, a special cash-flow statement was prepared (Annex 2 C). This shows the following picture. (The bracketed figure for 1956 shows profits before the loss on the transfer of the railroad.)

Profits before Depreciation, Pre-profit Allocations to Reserves and Taxes  
(in thousand £sterling equivalent)

1952	1,042
1953	842
1954	678
1955	781
1956	427 (634)

18. There has evidently been a fairly consistent though moderate decline in the company's earning power in recent years. The 1956 adjusted net profits after taxes of £370 million represent only 5.7% of the equity revalued in accordance with the replacement value of net fixed assets. This is not very satisfactory, but a substantial improvement should result from the recent removal of price controls on coal. The company's depreciation policy and methods of inventory valuation, although generally aiming at the full replacement of existing assets in an inflationary economy, have not been consistently applied towards this end. It would be sound financial policy for the company to provide in future adequate allowances in these respects before calculating the profits available for distribution to shareholders.

### III. THE PROJECT

#### General

19. The Lota project involves essentially the concentration of operations to the new Piques Carlos Cousino mine and the simultaneous improvement and reconstruction of coal haulage installations, preparation plant, and storage and loading facilities. Development work would be pushed vigorously to provide new work areas in the so-called "new mine", where most of the company's reserves of coal are located.

#### Coal Reserves

20. The coal bearing horizon contains nine seams of coal, but not all of these are of workable thickness. In the Lota mines only seams 2, 3, 4,

and 5 have been worked. The new mine reserves are all located in the number 5 seam. Estimated reserves of workable coal for the old and the new mine in millions of tons are as follows:

	<u>Old Mine</u>	<u>New Mine</u>	<u>Total</u>
Proved	3.9	10.9	14.8
Indicated	--	6.2	6.2
Inferred	--	94.5	94.5

Proved reserves are sufficient to last until 1970 on the assumption that full production at 4,000 tons per day is reached in 1964. However, there is no doubt that by that time some of the presently indicated and inferred reserves will have been proved.

#### Planned Development and Construction

21. The present output is obtained mainly from the old mine which has an estimated capacity of about 3,600 tons per day (1.01 million tons per year assuming 280 work days). The company has, however, made the conservative assumption that, in 1957 and 1958, only about 850 and 875 thousand tons respectively could be marketed. From 1959 on, the rate of output would be determined by physical rather than market factors. As the old mine reserves are worked out, extraction from the new districts would be stepped up, and there would be a gradual increase in output to 4,000 tons per day by 1964 from the better faces in these districts. In 1960, the new preparation plant and the increased efficiency of handling and haulage facilities should result in a substantial reduction in costs. At the same time, the company should be able to obtain higher average sales prices, because of reduced breakage and of improved quality of coal due to more efficient preparation. (In the financial forecasts it has been assumed conservatively, however, that the preparation plant will not be in normal operation until 1961.)

22. The shafts and main haulage roadways at Piquez Carlos Cousino through which it is proposed to bring the future output to the surface are already in existence. Underground concentration will begin as soon as the necessary connecting roadways from the old mine to the new shafts have been completed. These connections have already been started and will be completed in 1957/60. This degree of concentration is independent of any expansion of output but it would bring about a considerable reduction in cost by reducing the number of haulage workers.

23. Besides connecting roadways it is necessary to undertake considerable development work. To complete this scheme, over a five year period beginning in 1957, 51 kilometres of development and connecting drivage (rock tunnelling) must be worked.

24. Other underground and surface construction includes equipping of the new shaft with up to date hoisting and decking facilities, electrification of hoisting equipment of one of the old shafts, coal preparation plant, stocking facilities, machine shop, engineers' offices, safety department and lamp room, foremen's building and baths.

25. Endesa will provide about 75% of Lota's power requirements estimated at 44 million Kwh per year. The rest, as in the past, will be supplied from the company's own small thermal station.

#### Work completed to date

26. A considerable amount of work has already been done towards the completion of the new installations including the sinking of the two shafts to the 500 metre level. Since 1952, one of the shafts has been equipped with modern hoisting machinery and decking facilities. A fan with a capacity of 300,000 cu. ft. per minute has been installed and a turbo-compressor is now being installed. A quantity of underground machinery including conveyors and mine cars has been acquired. The total cost of all this equipment installed since 1952 has been about U.S. \$3.2 million equivalent. Additional orders have been placed for equipment on a medium-term credit basis, and at the end of March 1957 about U.S. \$620,000 was still owed on this account. Another 200 million pesos have been spent for new buildings. All these investments have been financed from the company's own resources, without recourse to outside borrowing.

#### Engineering and Construction Management

27. No planning department exists at Lota and all the planning, engineering and construction supervision for the new installations scheme has so far been carried out by the operating staff of the company. The company has agreed, however, to set up a new department responsible for planning and development.

#### Operating Management

28. Lota's operating staff is well qualified. In order to relieve the Chief Mining Engineer of some of the burden of daily supervision of the mine, the company will hire a qualified engineer, to whom this responsibility can be delegated. The duties of the operating staff will also be lightened by the establishment of the new planning department.

#### Construction Schedule

29. According to the construction schedule, all the equipment for rock work should be delivered by the end of 1960, by which time the coal preparation plant should be completed. All the equipment for use at the coal faces should be delivered by the end of 1961, and the other installations should be finished by the end of 1962. The last deliveries of the imported equipment for which the company is seeking financial assistance from the Bank, should take place during the first half of 1962.

#### Estimated Cost in Foreign Exchange and Local Currency

30. The cost estimates for the various items of imported equipment are based, in many instances, on recent quotations from manufacturers, in other

cases from older quotations brought up to date by what the consultants considered to be suitable increments, and in one or two cases are the results of the best estimate made by the consultants from their experience of similar installations elsewhere.

31. The total future capital requirements, both in foreign and local currency, for equipment and construction work for the projected new installations are set out below:

<u>ITEM</u>	<u>Foreign</u> <u>Exchange</u> (million U.S.\$ equivalent)	<u>Local</u>	<u>Total</u>
Winding, Ventilation and Compressors	1.27	0.76	2.03
Coal Preparation Plant and Conveyors	1.33	0.34	1.67
Workshops, surface traffic buildings and sidings	0.62	2.89	3.51
Underground haulage and electrical equipment, incline and staple shafts, trunk conveyors	2.01	0.36	2.37
Coal face equipment	1.22	0.04	1.26
Rock development work and equipment	0.53	1.46	1.99
Accounting equipment, trucks and vehicles for moving personnel	0.45	---	0.45
Contingencies	0.68	---	0.68
Interest during construction	<u>1.49</u>	<u>0.42</u>	<u>1.91</u>
Total	<u>9.60</u>	<u>6.28</u>	<u>15.88</u>

32. The estimate for each item of imported equipment includes an allowance for possible price advances of 5% per year, as recommended by the consultants and also an allowance for spare parts which averages about 4%. The allowances for spares are not higher, because the company's repair shops will be able to manufacture many items, so that there will be no need to hold large stocks of spares. The contingencies item for foreign exchange costs represents an allowance of 10% on all items plus an additional 10% on the coal preparation plant. The total amount of contingencies included in the foreign exchange estimates is about \$1,550,000.

33. The local cost estimates have been calculated on a conservative basis, using 1957 prices for labor and materials and adding to each item an allowance of 17%, which is the present best estimate of the increase in local prices likely to take place in 1958. The estimate for rock development work contains a very substantial contingencies allowance.

34. It is recognised that the inflationary trends of recent years may continue during the construction period, but it is not practical to make any estimate of the amount by which the local currency investment costs may exceed the estimates on this account. The local currency financing arrangements (described in Chapter VI below) provide an assurance that the company will have at its disposal sufficient local currency resources to complete the project.

35. Subject to the above comment on the local currency elements, the cost estimates are reasonable.

36. Equipment and services proposed to be financed by the Bank loan will be procured, as far as practicable, on the basis of international competition.

#### Labor Requirements

37. When the new installations are completed, the number of men required to be at work underground and on the surface of the mine (excluding workshops, preparation plant, administration, etc.), will have decreased from the present figure of approximately 4,600 to 3,350 and the output per man shift (underground and at the head of the shaft), should increase from 0.67 tons to 1.13 tons. In particular, the output per haulage worker would be increased from the present figure of 2.5 to about 6.7 tons per shift.

38. In general, the average rate of reduction of the labor force should be no more than the normal reduction on account of retirements, etc., but careful plans would need to be made for 1961 and 1962 since in this two-year period the reduction in labor requirements might exceed this normal rate.

#### Supervision at the Face

39. The ratio of workmen to supervisors at Lota is approximately 50:1 and this figure is completely inadequate by European (19 in the U.K.), and American standards. This indicates the need for additional supervisory personnel at the lower level to improve production and quality of work.

### IV. THE MARKET

40. A market analysis has been undertaken jointly by the Schwager and Lota companies according to specifications suggested by the Bank. This analysis which is summarized in Annex 4 falls into two parts: a study of coal-oil competition and a detailed analysis of the demand for coal by sectors 1956-1964.

41. Assuming present import duties and taxes for fuel oil and diesel oil, the estimated future prices for coal and oil are shown to be almost exactly the same on a coal equivalent basis. This is assuming (a) an equivalent of 1.7 tons of screened coal per ton fuel oil and (b) a decline to the pre-Suez level both of fuel oil quotations f.o.b. Aruba <sup>1/</sup> and of ocean freights Aruba-Chile. Both these assumptions are conservative.

42. The detailed analysis, by sectors, shows demand for coal growing rather slowly from the present level of 2,050,000 tons by 210,000 tons through 1960 and an additional 459,000 tons through 1964. Reflecting, in part, the very conservative production forecasts by both Lota and Schwager and the expected temporary decline in the production by small producers (some of the mines will be closed), the total production of coal is shown to be lower than actual demand during 1957-59 and only slightly higher in 1960. According to the data presented by the companies, the combined Chilean output would again fall short of demand in 1961-62. Only in 1963, as the new Schwager mine goes into nearly full production, would there be a slight temporary surplus of about 100,000 tons which would fall to negligible proportions in 1964 and subsequent years.

43. The following comments may be made regarding these forecasts by the companies:

(a) The conclusion that there will be no appreciable surplus in 1957-1960 is accepted.

(b) A more cautious appraisal of total demand 1961-1966 suggests that it may fall short by 150-200,000 tons per year of the company estimates. In 1961-62, this would be due mainly to faster railroad electrification; in 1963-66 mainly to a slower increase in requirements for thermal power.

(c) It would be more conservative to assume a production by small mines of 600,000 tons of coal from 1961 on rather than 525,000 tons, as assumed by the companies.

Detailed reasons for these comments are given in Annex 4. They suggest possible surpluses of coal of the following orders of magnitude:

1961	250,000 tons
1962	100,000 tons
1963	400,000 tons
1964-1966	300,000 tons declining towards 250,000 tons

44. The figure for 1963 corresponds to about 15 per cent of the estimated total demand in that year. There are good prospects for eliminating or at least reducing this surplus through sales of coal to Argentina (including sales of coking coal) and/or through additional sales to thermal power stations,

<sup>1/</sup> The Netherlands West Indies basing point for prices of oil products.



if a new power station is established on the mine fields to serve the Concepcion market. Nevertheless, it is better not to include these possibilities in a conservative appraisal of the future market.

45. (Deleted)

46. No consideration has been given above to the special measures that the Chilean Government may introduce (over and above the existing protection against fuel oil) to stimulate consumption of coal or otherwise aid the industry. According to a letter from the Ministry of Mines to the Corporacion de Fomento, dated April 2, 1957, it is a main preoccupation of the Chilean Government to secure a market for the planned output of the domestic coal mining industry. In order to achieve this end, the Government will, if necessary, take special measures to stimulate coal consumption and lower coal production costs, and also to coordinate the consumption of various types of fuels.

#### V. ECONOMIC JUSTIFICATION

47. Although coal was shown to be commercially competitive with fuel oil, it should be noted that import duties and taxes constitute about one-third of the price of fuel oil as compared with only a negligible portion for coal. In view of this substantial protection, the question of the economic justification for the project becomes very pertinent.

48. In the appraisal of the market, very conservative assumptions were made regarding the future world price level for oil, and attention was focussed on the part of the market where coal is in the least favorable competitive position, where sales of fuel oil are made to large consumers at no mark-up over the so-called quoted price c.i.f. Chilean port. In appraising the project from the general economic point of view the following criteria would seem more appropriate in comparing Chilean coal with the major rival fuel, imported oil:

(a) The comparison need not be based on such a pessimistic assumption concerning oil prices as is appropriate for a cautious market appraisal on which financial forecasts are based. If oil prices were to remain at about their present level, they would be about 3,000 pesos per ton higher than the prices assumed in the market study.

(b) In the same way, the most likely price for coal would reflect somewhat lower costs than those assumed for the purposes of the financial forecasts. Furthermore, even on the basis of those costs, there may be some scope for lowering the assumed prices, particularly in the late 1960's.

(c) In some sectors of the market, coal is fully competitive with oil without tariff protection (e.g. coking coal for the steel industry) and in other areas coal would not need the full amount of the present customs and tax protection.

49. On these more favorable assumptions the average protection needed by coal would be only about 10%. This degree of protection would be more than justified by various benefits to be derived from continued coal production, namely:

(a) savings in foreign exchange (roughly \$70 million equivalent per year which compares with total Chilean imports 1955 of \$399 million equivalent);

(b) prevention of substantial unemployment which would occur if the mines were to close down. The mobility of labor in the Chilean coal industry is probably low due to the local concentration of the industry and the fairly specialized type of employment.

(c) the guarantee of a strategic minimum supply of fuels. Domestic coal at the present moment accounts for about one-quarter of the total Chilean energy consumption.

## VI. FINANCING PLAN AND FINANCIAL PROJECTIONS

### Financing Plan

50. The company proposes to borrow \$9.6 million equivalent (6.24 million pesos) from the Bank to finance foreign exchange expenditures for the project 1957-1962. The Corporacion de Fomento (CORFO) has agreed to finance that portion of the domestic currency requirements which Lota will not be able to finance out of its own resources, presently estimated at 1.83 billion pesos. According to the financial projections, the company itself would generate about 10.0 billion pesos over the period 1957-1962 in depreciation allowances and net profits, most of which would be reinvested. The availability and the proposed uses of funds during the period 1957-1962 are estimated as follows:

<u>Sources of Funds</u>	<u>Billion Pesos</u>	<u>\$Million Equivalent</u>
Depreciation and depletion	4,209	6,475
Allocation to insurance fund	210	323
Net profits before interest	5,201	8,002
	<hr/>	<hr/>
Company generation of funds	9,620	14,800
IBRD loan	6,240	9,600
CORFO loan	1,829	2,814
	<hr/>	<hr/>
	<u>17,689</u>	<u>27,214</u>

<u>Uses of Funds</u>	<u>Billion Pesos</u>	<u>\$Million Equivalent</u>
Project Investment	10,319	15,875
Other Investments	2,299	3,537
Increase net working capital	1,835	2,823
Debt Service	903	1,389
Dividends	826	1,271
"Additional Assets" <sup>1/</sup>	<u>1,507</u>	<u>2,318</u>
	<hr/>	<hr/>
	<u>17,689</u>	<u>27,214</u>

<sup>1/</sup> "Additional Assets" represents the accumulated excess of the company's sources of funds over its requirements during the period (as shown in Annex 6).

51. It has been assumed for purposes of calculation that the IBRD loan would be for 15 years, including a five-year grace period, and would carry interest at 5-5/8%. Interest during the grace period would be capitalized, but commitment charges would be paid out of current earnings. The CORFO loan would be for 13½ years with a 3½ year grace period and an assumed maximum interest rate of 6%; interest would be capitalized during the grace period. The shorter grace period for the CORFO loan is justified by the expected cash generation.

### Financial Projections

52. Financial projections (Annexes 5 and 6) are based upon the following major assumptions:

(a) Lota's sales of coal will increase from 850,000 tons in 1957 to 1.08 million tons in 1962 and 1.12 million tons in 1964 and future years. These projections are justified by market prospects. Apart from the market, the major present limitation on Lota's potential output is the availability of proven reserves. When sufficient additional reserves are proven, it would take only very limited investments to raise Lota's output to 5,000 tons per day as compared with the presently contemplated maximum of 4,000 tons.

(b) The projections reflect present prices for coal and an exchange rate of 650 pesos per U.S.\$.. It is assumed that any cost increases due to further depreciation of the Chilean currency (whether in the form of higher costs for imported equipment or increases in wages and other domestic cost elements) will be passed on in the form of higher prices.

(c) Projected production costs, verified by the Bank's consultants in July 1956 have been updated. They are now based upon the actual costs during the last quarter of 1956 adjusted for a 30.16% increase in wage rates and a 35% expected increase in material prices as well as for estimated increases in prices for electric power and in indirect costs. Allowance has also been made for the cost of additional engineers and foremen. Finally, provision has been made for additional depreciation based upon current replacement costs and for future wage increases (not compensated by price increases) of 0.75% per year. Since substantial portions of the new project will come into operation in the course of the construction period, and depreciation on each item begins as it is taken into operation, there is a rapid increase in depreciation allowances throughout the construction period.

(d) 1957 sales returns have been reduced by 93 pesos per ton corresponding to a price concession to railroads and gas companies. This is a special contribution by the coal companies to the Government's anti-inflation program, and these concessions will be withdrawn from 1958 on.

(e) Although the new coal preparation plant is scheduled to be operating from 1960 on, it has been assumed conservatively that the corresponding gains through lower production costs and a higher average sales price will only occur from 1961 on.

(f) The total cost of development drivages in the period 1957-1961 will be about 3,300 million pesos, of which about 2,025 million will be charged to cost of production and 1,275 million will be capitalised. From 1962 on, all development work will be charged to cost. These cost assumptions are very pessimistic, being based on a rate of advance of only 800 metres per year, whereas a rate of 1,200 metres is probable and a rate of 1,500 metres possible.

53. The following additional assumptions have been made for the cash flow forecasts:

(a) Interest (but not commitment charge) on the proposed Bank loan and interest on the CORFO loan would be capitalised during the respective grace periods.

(b) Investments for replacement and modernization outside the project investment will correspond to one-half of the annual depreciation and depletion allowances during the period 1957-1966. After that time, it is assumed that the full annual depreciation and depletion allowances would be used for replacements and modernization. In addition, the company will reserve 5 per cent of their net profits for workers and employees' housing. This sum is included in the project investment (local expenditure) for the years 1957-1961.

(c) Dividends during the construction period will be limited to 20 per cent of earnings after taxes and will rise in 1962 and future years to 750 million pesos, corresponding to about 50 per cent of earnings after profit participation by workers and management and taxes and about 7 per cent on a realistic valuation of the company's equity at the end of 1962.

54. The above projects show an increase in Lota's annual net earnings after taxes from an estimated low of 275 million pesos for 1958 to 742 million pesos in 1959 as production picks up and to 1,230 million pesos in 1961, as the benefits from the new preparation plant start accruing. From 1962 on, the profits would vary roughly between 1,400 and 1,700 million pesos per year. Using a figure of 1,500 million pesos and relating this to a revalued equity as of the end of 1962 of 10.75 billion pesos, this would correspond to a return of about 14 per cent, which is very satisfactory.

55. The debt service coverage on the combined IBRD and CORFO debts would be acceptable for this type of industry, varying between 2.7 and 2.9 over the years 1963-1968. The cover would not be jeopardised even if output and sales fell considerably below the estimated levels. A 20% fall in sales would still provide the company with sufficient funds to cover its debt service requirements about 2.0 times in 1963 (as compared with the estimated cover of 2.7 times).

56. The company's latest balance sheet as of December 31, 1956 and pro forma balance sheet as of the end of the construction period December 31, 1962 are shown below. In the 1962 balance sheet, amortization payments falling due in the year 1963 are treated as current liabilities, and have consequently been deducted from the long-term debt. (Figures in million pesos)

	<u>Dec. 31, 1956</u>	<u>Dec. 31, 1962</u>	<u>Dec. 31, 1968</u>
<u>ASSETS</u>			
Current Assets	2,912	6,118	6,312
"Additional Assets"	--	1,507	3,381
Sundry Assets (non-current)	686	686	686
Fixed Assets	3,220	15,838	20,536
<u>less Depreciation and Depletion</u>	<u>- 373</u>	<u>4,582</u>	<u>-10,943</u>
Net Fixed Assets	<u>2,847</u>	<u>11,256</u>	<u>9,593</u>
Total Assets	<u>6,445</u>	<u>19,567</u>	<u>19,872</u>
<u>LIABILITIES AND EQUITY</u>			
Current Liabilities	1,869	3,887	4,272
Long-term debt, IBRD	--	5,510	1,901
CORFO	--	1,391	244
Various Provisions	634	844	1,262
Capital, Reserves, and Surplus	<u>3,942</u>	<u>7,935</u>	<u>12,193</u>
Total Liabilities and Equity	<u>6,445</u>	<u>19,567</u>	<u>19,872</u>
<u>RATIOS</u>			
Net Current Assets to Sales	17.8%	17.8%	17.8%
Debt to Equity	--	44:56	14:86

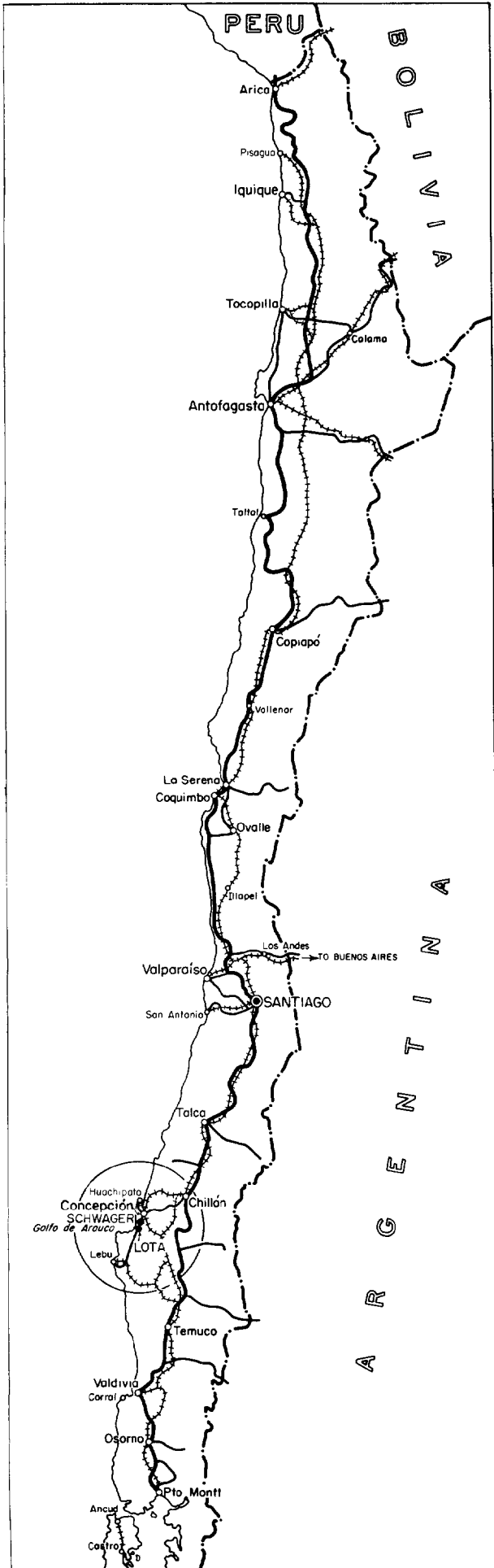
57. In calculating the ratio of net current assets to sales, the whole debt service payments for the year 1963 (i.e. not only the amortization quotas included under current liabilities in the above pro forma balance sheet) have been regarded as current liabilities.

58. The above pro forma balance sheet as of the end of December 1962 shows a sound financial position with respect to both liquidity and capital structure. Since the fixed assets were undervalued at the end of 1956, the debt-equity ratio at the end of 1962 would actually be better than that shown above.

VII. PROPOSED PROTECTIVE FINANCIAL ARRANGEMENTS

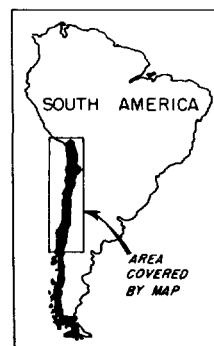
59. If a Bank loan is made for this project, the contractual arrangements should include undertakings by the company:



- (a) to limit cash dividends during the construction period to say 20% of net earnings (after taxes and profit participations by workers and management) accumulated since December 31, 1956. The object of this limitation is to ensure that most of the earnings are reinvested during the construction period.
- (b) to refrain from paying cash dividends which would unduly reduce the net working capital, which needs to be the equivalent of about one-sixth of annual sales.
- (c) not to incur additional long-term debt (apart from debt incurred to meet the expenses of the project) if as a result the total amount of long-term debt would exceed the equity.
- (d) not to incur short-term debt except in the ordinary course of business for working capital purposes, or by way of interim financing to be repaid out of the proceeds of the Bank loan or the loan to be obtained from CORFO.

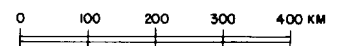


**MAP OF NORTHERN  
AND  
CENTRAL CHILE**

SHOWING LOCATION OF  
GOLFO DE ARAUCO AREA



MAIN ROADS   
MAIN RAILROADS 





## Annex 2 A

## Compania Carbonifera e Industrial de Lota

Summary Balance Sheets, 1951 - 1956  
(million pesos)

<u>Fiscal Years Ended Dec. 31</u>	<u>1951</u>	<u>1952</u>	<u>1953</u>	<u>1954</u>	<u>1955</u>	<u>1956</u>
End of year exchange rate (pesos per £ sterling)	230	340	355	560	840	1510
<u>ASSETS</u>						
Cash	13	47	16	48	105	67
Receivables (net)	154	242	336	456	635	1164
<u>Inventories</u>	<u>185</u>	<u>313</u>	<u>354</u>	<u>388</u>	<u>632</u>	<u>1681</u>
Total Current Assets	351	602	706	892	1372	2912
Bonds and Shares, held by company	19	124	100	369	742	512
" " " , deposited under guarantee agreement	47	62	135	91	305	173
<u>Transitory Assets</u>	<u>6</u>	<u>1</u>	<u>--</u>	<u>13</u>	<u>1</u>	<u>1</u>
Total Sundry Assets	72	187	235	473	1048	686
Mining Property	346	566	559	559	1090	1090
Buildings, Plant, Equipment, etc.	332	318	337	390	900	1202
Railroad, Vessels, etc.	215	255	294	231	458	8
Workers, Housing & Welfare Facilities	--	202	238	232	566	635
Farms and Forests	--	44	48	48	112	112
<u>Work under Construction</u>	<u>18</u>	<u>46</u>	<u>191</u>	<u>266</u>	<u>114</u>	<u>173</u>
Gross Value of Fixed Assets	912	1431	1667	1726	3240	3220
less Depreciation allowed by tax laws	- 247	- 149	- 205	- 244	- 216	- 312
<u>Additional Depreciation</u>	<u>- 5</u>	<u>- 28</u>	<u>- 28</u>	<u>- 43</u>	<u>- 61</u>	<u>- 61</u>
Net Fixed Assets	659	1253	1434	1439	2963	2847
Total Assets	1082	2042	2375	2804	5383	6445
<u>LIABILITIES AND EQUITY</u>						
Current Liabilities	49	50	102	166	256	1025
<u>Other Liabilities</u>	<u>101</u>	<u>259</u>	<u>263</u>	<u>341</u>	<u>445</u>	<u>844</u>
Total Liabilities	150	309	365	507	702	1869
Various Reserves (or Provisions)	90	179	271	327	531	634
Share Capital	369	369	1200	1200	1320	1500
Revaluation Reserve for Inventories	--	--	--	--	--	212
Revaluation Reserves for Fixed Assets	183	828	154	205	1495	1201
Reserves for Fluctuations in Security Values	34	41	149	212	871	508
<u>Other Reserves and Accumulated Profit</u>	<u>256</u>	<u>316</u>	<u>236</u>	<u>253</u>	<u>464</u>	<u>520</u>
Total Equity	842	1554	1739	1965	4121	3941
Total Liabilities and Equity	1082	2042	2375	2804	5383	6445

General Remark: The above headings have been summarized and rearranged in accordance with Bank practice. The classification, by major groups of assets, however, agrees with the published balance sheets. Accounts are audited by Price Waterhouse & Peat Co.

Footnotes to certain items:

Buildings, Plant, Equipment, etc.: The 1951 figure includes workers' housing and welfare facilities.

Farms and Forests: Not separately stated in 1951.

Inventories: Lota values its inventories for coal (345 million pesos at the end of 1956) according to the "First in First out" method. There have been repeated changes in the methods of valuation for other inventories (700 million pesos at the end of 1956). In 1951-1953 and throughout most of 1954, materials from these inventories were charged to operations according to the average cost of acquisition. In 1955, the company started applying a variant of the "Last in First out" (LIFO) method, charging materials to operations according to the "last cost at sight." The application of this method in a period of run-away inflation resulted in substantial credit balances on these inventory accounts. To compensate for this more than desired write-down, the company decided to value its final inventories as of December 1955 at December 1953 prices. The final 1956 inventories were revalued at current prices and the difference between current values and previous book values was credited to a special reserve for revaluation of inventories.

Although the valuation procedures used would appear unnecessarily complicated, in the end they probably came close to minimizing book gains or losses on inventories other than coal. For coal, the use of FIFO in 1955 and 1956 apparently resulted in book gains on existing stocks of about 50 and 100 million pesos respectively.

Other Liabilities: In fact, these are also of a current nature.

Annex 2 B

Compania Carbonifera e Industrial de Lota

Summary Profit and Loss Statement, 1951 - 1956  
(million pesos)

<u>Fiscal Years Ended Dec. 31</u>	<u>1951</u>	<u>1952</u>	<u>1953</u>	<u>1954</u>	<u>1955</u>	<u>1956</u>
End-of-year exchange rate (pesos per £ sterling)	230	340	355	560	840	1510
<u>INCOME</u>						
Sales of coal	995	1126	1596	2348	3910	5846
Income from Ceramics plant, shipping, etc.	89	54	--	--	--	--
Interest	12	22	41	44	105	222
Extraordinary revenue	<u>11</u>	<u>--</u>	<u>8</u>	<u>40</u>	<u>31</u>	<u>55</u>
	1107	1202	1645	2432	4046	6123
<u>EXPENDITURE</u>						
Wages and Salaries, Materials & Supplies	688	591	952	1327	2274	3405
Social Security & Welfare Payments	182	265	327	524	951	1464
Depreciation of Fixed Assets						
allowed by tax authorities	47	60	58	62	84	103
additional	5	23	--	20	42	--
Write-down of invest., secur., receiv.	11	10	13	27	42	9
Write-down of coal stocks	--	--	--	--	--	82
Sundry charges	38	56	76	120	231	272
Extraordinary expenditure	--	--	--	47	--	243
Interest	5	13	19	38	80	123
Income & Real Estate Taxes	33	60	58	94	124	140
Net Profits	<u>98</u>	<u>125</u>	<u>142</u>	<u>172</u>	<u>217</u>	<u>282</u>
	1107	1202	1645	2432	4046	6123
Ave. Equity and "Provisions"	(932)	1353	1892	2154	3437	4628
Profits after Income Taxes/Ave Equity and Provisions	(10.5)%	9.3%	7.5%	(8.0)%	6.3%	(6.1)%

Footnotes to certain items

Extraordinary expenditure: The figure for 1954 represents loss on sale of vessels to new subsidiary; the 1956 figure is composed of loss on operations of Concepcion - Curanilahue railroad (152) and on the sale of this railroad to the Government (75) plus certain related expenses (16).

Write-down of coal stocks and Inventory Valuation: See footnote under balance sheet.

Ratio of Profits to Equity: Percentages within brackets are misleadingly high since in those years there was no revaluation of assets in spite of substantial inflation.

Depreciation Allowances: The differences between the figures in Annex 2A and those in this Annex are explained in the footnote to Annex 2C.

Annex 2 C

Compania Carbonifera e Industrial de Lota

Sources and Allocation of Funds

<u>Fiscal Years Ended December 31</u>	<u>1952</u>	<u>1953</u>	<u>1954</u>	<u>1955</u>	<u>1956</u>	<u>1952</u>	<u>1953</u>	<u>1954</u>	<u>1955</u>	<u>1956</u>
	<u>in million pesos</u>					<u>in thousand £-sterling equivalent</u>				
End-of-year exchange rate (pesos per £)	340	355	560	840	1510	340	355	560	840	1510
<u>SOURCES</u>										
Depreciation allowances	83	58	82	126	103	291	167	179	180	88
Reservations before net profits	89	92	56	204	104	312	265	123	291	88
Net Profits after Taxes	<u>125</u>	<u>142</u>	<u>172</u>	<u>217</u>	<u>295</u>	<u>439</u>	<u>409</u>	<u>376</u>	<u>310</u>	<u>251</u>
Total Sources	297	292	310	547	502	1042	841	678	781	427
<u>ALLOCATION</u>										
Plant and Equipment	32	225	36	260	356	112	648	79	371	303
Loss on Donation of Railroad	--	--	--	--	-75	--	--	--	--	-64
Sundry Assets	108	-60	134	-42	1	379	-173	293	-60	1
Increase in Net Working Capital	92	48	44	285	161	323	138	96	407	137
Dividends	<u>65</u>	<u>79</u>	<u>96</u>	<u>44</u>	<u>59</u>	<u>228</u>	<u>228</u>	<u>210</u>	<u>63</u>	<u>50</u>
Total Allocation	297	292	310	547	502	1042	841	678	781	427

Footnotes

Conversion into Sterling: This conversion has been made at the average of the market rate at the beginning and the rate at the end of the year.

Special Comment Regarding 1956: But for the extraordinary losses on the donation of the Concepcion - Curanilahue railroad and on the operation of this railroad, the gross profits (= total sources in the above table) would have been higher by £ 207,000.

Plant and Equipment, Sundry Assets, Net Working Capital: Changes in the revaluation reserves for fixed assets, securities, and inventories have been excluded from the "Sources." The above figures therefore do not include revaluation gains (except possibly, to a minor extent, in inventories).

Net Profits after Taxes in 1956: The figure shown here corresponds to the figure shown in the profit-and-loss statement (282 million pesos) plus profits from the sale of certain assets (13 million pesos) credited directly to a special reserve.

Plant and Equipment and Depreciation Allowances: The totals shown above are higher than the net increases in the Fixed Assets and Depreciation accounts shown in the balance sheets in Annex 2A. The differences represent the gross value of assets retired during the year and the accumulated depreciation on these assets.

LOTA MINE Annex 3

Schedule of Development Drivages  
(in metres)

<u>Section in sq. metres</u>	<u>17</u>	<u>12.5</u>	<u>11</u>	<u>Staple Shaft</u>	<u>Total</u>
<u>Year</u>					
1957	5,940	5,960	--	--	11,900
1958	5,620	6,200	--	120	11,940
1959	2,700	6,000	1,446	--	10,140
1960	2,760	5,740	3,080	--	11,580
1961	720	4,320	680	--	5,720
1957-1961	17,740	21,220	5,200	120	51,280

## Annex 4

### The Market for Coal

#### The General Energy Picture

1. In 1952, coal accounted for somewhat less than 30% of the total Chilean energy consumption (excluding gasoline). Firewood and black oils were responsible for about 25% each, and hydro-power supplied the balance of 20%.
2. Apparent consumption of coal rose from 2.2 million tons in 1950 to a high of 2.6 million tons in 1952 and has since declined steadily to about 2.1 million tons in 1956 (preliminary estimate). Imports have averaged about 0.2 million tons during the last four years, representing mainly imports of coking coal by the Chilean Steel Company. Lota and Schwager over the same period supplied 74-77% of the Chilean output; the balance was provided by several small mines. The stagnation in coal output is explained by the lack of economic expansion and, to a lesser extent, by loss of markets to oil.
3. Chile is very rich in hydro-power resources, which have thus far been only partially developed. Long-range plans aim towards an even supply of hydro-power throughout normal years, taking advantage of the different seasonal flows at different latitudes and the large potential storage capacity of highland lakes. In these schemes, thermal power will play only a very limited role.
4. The consumption of black oils (fuel oil and gas/diesel oil) was stationary in the period 1947-1953. Very heavy taxes and import duties (together they represent over 50% on the c.i.f. value) are levied on these fuels. These were compensated to some extent by preferential exchange rates (now abolished) which are said to have been responsible, at least in part, for the increase in fuel oil consumption from 850 thousand tons in 1953 to 970 thousand tons in 1955 and in gas/diesel oil consumption from 160 to 230 thousand tons. Two-thirds of the fuel oil is used by mining companies (mainly copper and nitrate mines), and the remainder mainly for general distribution in Central Chile. According to the market study made by the coal companies, and from information supplied by Empresa Nacional de Petrolio, consumption of fuel oil (primarily for general distribution) would rise from 970 thousand tons in 1955 to 1.4 - 1.6 million tons in 1965.
5. Of great potential importance is the recent development of crude oil and refinery production in Chile. The production of crude in the Magallanes fields rose from 400,000 cu.m. in 1955 to 600,000 cu.m. annual rate in August-October 1956. Most of this crude is shipped to the new refinery at Concon near Santiago with a reported capacity of 850,000 tons of refined products per year, of which about 100,000 tons would be gas/diesel oil and 250,000 tons fuel oil. The planned increase in the capacity of this refinery would further increase the potential supply of fuel oil to about 580,000 tons. Another possible source of fuel for Chile is natural gas from the Bolivian fields which, according to a recent project, would be piped to the copper mines in Northern Chile.

6. The initial effect of increased Chilean production of crude and of supplies of Bolivian gas would be to displace imported crudes rather than to displace coal. Since only 25% of the refinery yield would be fuel oil, it would take about 3.9 million tons (4.4 million cu.m.) of Chilean crude to supply even the present consumption of fuel oil. This does not take into account possible limitations in refining capacity. In conclusion, although such spectacular increases in Chilean production of crude and refined products cannot be entirely ruled out, these possibilities are not so imminent as to justify their consideration in the forecasts for the future coal market. The competition between coal and imported oil, on the other hand, is of great importance.

Competition Coal-Oil

7. Coal and oil are in competition for virtually every segment of the fuel market: power stations, industries, households. The following figures summarize the competitive position of the two fuels at the present moment at San Antonio (representative for coastal locations) and Santiago, the largest inland market.

TABLE 4 A

Comparison of Coal and Oil Prices  
(pesos per ton oil equivalent)<sup>1/</sup>

	<u>Ex Mine</u>	<u>Delivered Cost</u> <u>San Antonio</u>	<u>Delivered Cost</u> <u>Santiago</u>	<u>Quoted Price</u> <u>Santiago</u>
Price for screened coal	18,785	23,763	25,177	28,184
Price for slack	17,800	23,266	25,276	28,158
Estimated prices for fuel				
<u>oil#6</u>				
Full "normal" price <sup>2/</sup>		27,900		31,120
Net "normal" price, including sales tax <sup>2/</sup>		23,710		27,270

<sup>1/</sup> In agreement with the companies, the following equivalents were used:  
1 ton of fuel oil = 1.7 tons of screened coal  
or 2.0 tons slack

This takes into account differences in thermal values as well as the greater convenience of fuel oil.

<sup>2/</sup> As explained in the text, the "normal" price has been estimated after suitable deductions for the recent inflationary increases in oil prices and ocean freights. The "full" normal price corresponds to the quoted price, including distributive mark-up and sales tax. The net normal price excludes the distributive mark-up, and because of this exclusion the sales tax is also lowered.

8. It is assumed that the price for fuel oil c.i.f. Chilean port in September 1956 represented a normal market level. The current market price is higher for two reasons: (a) an increase in the basis quotation f.o.b. Aruba, Netherlands West Indies (b) a substantial increase in the freight allowance Aruba-Valparaiso. The increase in the Aruba quotation is mainly a reflection of higher crude values resulting from the Suez crisis; while the increase in tanker rates reflects the abnormal shortage of tanker space. A conservative assumption is that both the f.o.b. quotation and the freight allowance will recede to the pre-Suez level. A further decline in the Aruba quotation below the pre-Suez level is not likely.

9. The coal companies have no information on the rebates, if any, below the full price secured by major oil consumers. According to information received by the Bank, the Chilean State railroads pay only the net or posted price for diesel oil, and experience from the United States suggests that the same may be true for the consumption of fuel oil by large utilities or industrial concerns. It is conceivable, however, that, in some important areas of competition between oil and coal, the oil companies in Chile would not be willing to forego the whole of their mark-up over the posted price. The comparison with coal on the basis of net prices plus sales tax for oil, therefore, rests upon the most unfavorable assumption for coal. On this conservative basis, coal would be somewhat less expensive than fuel oil at the port of San Antonio but would be slightly more expensive at Santiago. This continued close competition with oil should be kept in mind in the following review of the market prospects, by sectors.

The outlook for demand, by sectors

9. The following table shows the present and the estimated future consumption, by sectors, according to a market study prepared jointly by the two companies:

TABLE 4 B

	<u>1956</u> <u>Actual</u>	<u>1958</u>	<u>1960</u>	<u>1962</u>	<u>1964</u>
Mines own consumption <sup>1/</sup>	150	150	150	150	150
Railroads	522	507	22	40	389
Chilena Electricidad	81	218	227	462	574
Gas de Santiago	167	139	100	80	80
Other gas companies	47	48	48	21	22
CAP	325	335	335	450	570
Cement industry	214	204	240	260	261
Mining industry	45	45	95	95	95
Other industry	259	313	333	357	376
Shipping <sup>1/</sup>	141	112	85	83	50
Other	<u>100</u>	<u>114</u>	<u>126</u>	<u>139</u>	<u>153</u>
	2,051				
	<u>2,051</u>	<u>2,185</u>	<u>2,261</u>	<u>2,537</u>	<u>2,720</u>

<sup>1/</sup> "Mines consumption" includes consumption by Aravco and Coronel shipping companies, which consumption is therefore excluded from shipping.

TABLE 4 B (continued)

Actual or Estimated Production

Lota	960	873	1,042	1,080	1,109
Schwager	724	650	723	812	1,120
Small Mines <sup>2/</sup>	<u>500</u>	<u>662</u>	<u>496</u>	<u>645</u>	<u>491</u>
	2,184	2,185	2,261	2,537	2,720

Deduct:

Increase in stocks	(-133)
= Consumption	<u>2,051</u>

<sup>2/</sup> For 1958-1964 the figures shown for small mines represent the difference between the estimated total consumption and the estimated production by Lota and Schwager as shown in their financial forecasts.

10. The following comments may be made regarding these estimates:  
Railroads. The expected decline in consumption is attributed to the electrification of the Santiago-Chillan section estimated to take place between 1958 and 1960. According to the Bank's railroad consultant, this electrification would, within the course of roughly one year (say, the year 1961), reduce coal consumption by about 220,000 tons (based upon information supplied by the Chilean State Railways April 24, 1957). The companies, relying also upon information supplied by the State Railways, have estimated that the reduction in coal consumption attributable to electrification (plus some additional dieselization 1964-1966) would be about 47,000 tons in 1961 and would rise gradually to about 220,000 tons in 1966. The reasoning behind these different assumptions will have to be clarified. Ultimately, the State Railways would hope to electrify the branch lines to San Antonio and Concepcion and also the southward extension of the main line (to Temuco and Puerto Montt). No time schedule has been fixed, and the Bank's consultant regards it as unlikely, for financial reasons, that this scheme would be initiated over the next ten years. The same is true for dieselization of sections which are not to be electrified since the transfer of steam locomotives from electrified lines is likely to postpone the date that dieselization can be considered. No redundant locomotives could be transferred to the Northern Section, however, since this section operates on a different gauge. Complete dieselization of this section (not presently contemplated) would mean the further loss of a market for about 45,000 tons of coal.

Chilena Electricidad. This is a subsidiary of American & Foreign Power which owns about 164,000 kw of generating capacity in the Valparaiso-Santiago region, and distributes about 75 % of the total energy sold in that region. The Valparaiso-Santiago region accounts for about 75% of the total consumption in the areas to be included in the Interconnected Endesa system. (Endesa is the Government corporation responsible for overall planning and development of



Chilean power resources.) According to plans submitted by Endesa in May 1956, consumption and output of power were expected to grow in the following manner over the next decade (million kwh):

TABLE 4 C

	<u>1956</u>	<u>1958</u>	<u>1960</u>	<u>1962</u>	<u>1965</u>
Total consumption	2,069	2,660	3,484	4,068	4,997
Hydro-production (firm power only)	1,974	2,380	3,799	4,183	4,352
Required thermal production <sup>1/</sup>	95	280	176	129	645
Available thermal power	285	329	356	429	647
of which 3rd region (Valparaiso-Santiago)	270	270	330	410	630
3rd region from new stations	-	-	160	240	420

<sup>1/</sup> The thermal production shown is that portion which cannot be replaced by hydro-power. In 1960 and 1962 there would be an excess of hydro-power.

11. According to the original plans, new thermal capacity would be commissioned in 1960, 1961 and 1965. Since then the plans have been revised. Two 50,000 kw thermal units equipped for dual firing (coal or oil) have been ordered, and would start operating in the Valparaiso-Santiago region in 1961. Moreover, instead of supplying the balance which could not be provided by hydro-power, these new thermal units would operate as base-load plants. This would represent a total generation of 600 million kwh (based upon 8 months) from 1961 on, assuming the old thermal plants were put on a stand-by basis. Using a factor of 0.7 kg of slack per kwh, this would mean a total coal consumption of 420,000 tons per year. This agrees reasonably well with the coal consumption shown in the table under para.9. According to tentative plans, Endesa would install an additional 150,000 kw of thermal power by 1966. The estimated total coal consumption is given as 565,000 tons corresponding to about 800 million kwh which suggests that this additional capacity would be used mainly for peak loads.

12. In conclusion, present Endesa plans indicate a reasonably assured outlet for about 420,000 tons of coal for thermal power from 1961 on. Any increases above this level are at this moment highly speculative since they would depend upon the role assigned to thermal power (whether base-load or peak-load), and where base-load use is contemplated, upon the relative advantages by 1965 of conventional steam power as compared with hydro-power or atomic power.

13. According to the information received, the new 50,000 kw unit would use oil or coal depending upon the relative cost of the two competing fuels at any one moment. In view of uncertainties regarding the future coal-oil price relationship, thermal power generation cannot be counted as an assured market for coal. Nevertheless, in view of the present Government policy of favoring

Chilean coal, it has been assured that the companies can plan for minimum annual sales to power stations amounting to 420,000 tons.

Cia Acero del Pacifico. At the present moment, this steel mill is using a 65/35 blend of Chilean and imported United States coal, corresponding to a consumption of Chilean coal of about 330,000 tons of which Schwager and Lota each supply about one-half.

10. Based upon an estimated 73 per cent increase in CAP's coke requirements by 1964 and an unchanged proportion of Chilean and imported coal, CAP's consumption of Chilean coal would increase to 570,000 tons. The price for imported coal was \$17.40 c.i.f. in January 1956 and \$18.80 in January 1957 corresponding to Ch. pesos 11,310 - 12,220 per ton. This compares with the present price for washed slacks of 9,945 pesos per ton ex mine Schwager or Lota. Since Chilean coal is competitive with imported coal, the companies should be able to reach the above sales target, assuming that the expected increase in steel-mill operations will be achieved.

Gas Companies. The estimated decrease in coal consumption is due to the fact that both the Santiago and the Valparaiso gas companies expect to receive refinery gas from the Concon oil refinery.

Other consumers. On balance, an increase of about 120,000 tons is expected between 1956 and 1960 and a further 71,000 tons between 1960 and 1965. There would be substantial increases for sugar factories, metal smelters, cement plants, and breweries, while there would be a substantial decline for shipping companies. This forecast appears optimistic in some respects (continued use of 50,000 tons of coal by shipping companies, consumption of another 50,000 tons by a new smelter at Papudo, a further 55,000 tons by new beet sugar factories, increased consumption by PaPeles y Cartones). On the other hand, some as yet unforeseen industrial expansion will undoubtedly take place between now and 1965.

11. In the past the two companies have had certain difficulties in disposing of their slack coal (coal under 3/4" size, representing about 40 per cent of the total output). Thus, the stocks of slack at the mines increased from 26,000 tons on December 31, 1955 to 123,000 tons as of April 10, 1957. Both companies at present have facilities for washing some of their slacks but these washing plants are outmoded, and only limited quantities are actually washed. Both the Lota and the Schwager projects include new coal preparation plants, and in the new plants all the coal would be washed except fines under 1/8" as compared with the present cut-off points of 3/4" - 1". These fines would either be burned in the companies' own thermal plants or mixed back with the slack for sale to certain customers, e.g. cement plants. The lower cut-off point for the cleaning and the increased possibilities of mixing the small fines with cleaned slack are expected to do away with the special marketing problem for slack. The new Schwager coal preparation plant would be in operation from January 1, 1960 on, while the Lota plant would start January 1, 1960 at the latest.

12. One special problem concerns the sale of metallurgical coal to CAP, which can only use coal with a maximum sulphur content of 1.2 - 1.4 per cent. While this presents no problem for Lota, only about 30 per cent of the present Schwager output meets this standard. This is only slightly in excess of the quantities Schwager would hope to sell to CAP by 1964. While the risk for insufficient availabilities of such coal cannot be entirely ruled out, analyses of coal from the seams struck on the other side of the Linderos fault in Schwager suggest that, in fact, the proportion of low-sulphur coal will be substantially higher in the future.

Output by Small Mines

13. The market for Schwager and Lota also depends upon the output that may be expected from the small coal mines. Over the period 1948-1956, fifteen small mines operated during one period or another. Eight of these mines never produced more than 5,000 tons per year; six of these have been closed since 1953 and the remaining two ceased operations this year. The development of small mine production since 1948 may be seen from the following summary (th. tons):

TABLE 4 D

	<u>1948</u>	<u>1950</u>	<u>1952</u>	<u>1954</u>	<u>1956</u>
Colico Sur	40.9	59.5	98.9	109.8	128.5
Pilpilco	40.0	70.9	84.9	95.3	106.2
Victoria	5.9	41.3	47.0	56.0	55.4
Plegaria	128.0	-	-	27.3	60.1
Catamutun (lignite mine)	-	-	-	-	27.1
El Chilco	3.9	11.5	25.4	22.7	4.4
Lirquen (lignite mine)	138.0	126.5	152.7	132.4	113.1
Other	<u>12.2</u>	<u>2.6</u>	<u>1.6</u>	<u>7.8</u>	<u>5.0</u>
	<u>369.1</u>	<u>312.3</u>	<u>410.5</u>	<u>451.3</u>	<u>499.8</u>

14. The above mines are all located in the Concepcion and Arauco area. The first three mines are partly owned by Corfo. All except Lirquen sell a major portion of their output to the railroads. Only Victoria and Lirquen have facilities for shipping their coal by sea. There has been a fairly steady increase in their output in recent years. On the basis of these past trends, Lota and Schwager estimate that the small mines might produce as much as 750,000 tons by 1965. In early May 1957, however, there were indications that two of these mines may be permanently closed; the Victoria mine which is being operated at a substantial loss and the Plegaria mine where safety conditions are said to be unsatisfactory. Although no final decision has been reached, it now appears likely that the 1958 output from the small mines would not be much above 400,000 tons, and that 600,000 tons would be an absolute maximum for 1962 which might result e.g. from the planned expansion at Colico Sur to 200,000 tons (1960) plus various minor increases from

other mines. According to the most recent forecast made by the Mines Department, with which Lota and Schwager concur, it is, in fact, unlikely that production would exceed 525,000 tons.

### Conclusion

15. In conclusion, although the market forecast prepared by the companies is based upon generally conservative assumptions, it is subject to considerable uncertainties, in the following respects:

- (1) consumption by railroads, in particular 1961 and 1962
- (2) consumption by power stations from 1963 on
- (3) output by small mines from 1963 on.

An idea of the possible reductions in the sales by the two companies as a result of these factors is shown in Table 4 E. This table suggests possible surpluses of coal of the following orders of magnitude:

1961	250,000 tons
1962	100,000 tons
1963	400,000 tons
1964-1966	300,000 tons declining towards 250,000 tons

16. The figure for 1963 corresponds to about 15 per cent of the estimated total demand in that year. There are good prospects for eliminating or at least reducing this surplus through sales of coal to Argentina (including sales of coking coal) and/or through additional sales of thermal power, if Endesa agrees to establish a new power station on the minefields. Nevertheless, it is better not to include these possibilities in a conservative appraisal of the future market.

TABLE 4 E

Estimated consumption and supplies of coal and possible surpluses, 1956-1966  
(thousand metric tons)

	<u>1956</u>	<u>1957</u>	<u>1958</u>	<u>1959</u>	<u>1960</u>	<u>1961</u>	<u>1962</u>	<u>1963</u>	<u>1964</u>	<u>1965</u>	<u>1966</u>
<u>Estimated Consumption</u>	2,051	2,055	2,183	2,224	2,260	2,332	2,536	2,585	2,719	2,729	2,732
<u>Estimated Supplies (Original Company Estimates)</u>											
Lota	960	851	873	1,026	1,042	1,053	1,081	1,081	1,120	1,120	1,120
Schwager	724	650	650	712	723	747	812	1,085	1,120	1,120	1,120
Small mines	(500)	510	390	465	525	525	525	525	525	525	525
Increase in stocks	(-133)	--	--	--	--	--	--	--	--	--	--
Deficit (+) or surplus (-)	--	44	208	21	- 30	7	118	-106	-46	-36	-33
<u>Total Supplies</u>	<u>2,051</u>	<u>2,055</u>	<u>2,183</u>	<u>2,224</u>	<u>2,260</u>	<u>2,332</u>	<u>2,536</u>	<u>2,585</u>	<u>2,719</u>	<u>2,729</u>	<u>2,732</u>
<u>Revised Estimate of Possible Surpluses</u>											
Surplus (+), as above		-44	-208	-21	30	-7	-118	106	46	36	33
Reduced demand by railroads		--	--	--	--	173	115	53	38	18	47
Reduced demand by power stations		--	--	--	--	--	42	154	154	154	154
Possible additional output by small mines		--	--	--	--	75	75	75	75	75	75
<u>Total Surplus</u>		<u>-44</u>	<u>-208</u>	<u>-21</u>	<u>30</u>	<u>241</u>	<u>114</u>	<u>388</u>	<u>313</u>	<u>285</u>	<u>262</u>

Annex 5

Compania Carbonifera e Industrial de Lota

Costs and Earnings Projections, 1957 - 1968

<u>Fiscal Years Ended Dec. 31</u>		<u>1957</u>	<u>1958</u>	<u>1959</u>	<u>1960</u>	<u>1961</u>	<u>1962</u>	<u>1963</u>	<u>1964</u>	<u>1965</u>	<u>1966</u>	<u>1967</u>	<u>1968</u>
Output of Raw Coal	th. tons	851	873	1026	1042	1053	1081	1081	1120	1120	1120	1120	1120
Mine Consumption & Washing Losses	th. tons	<u>101</u>	<u>91</u>	<u>114</u>	<u>127</u>	<u>139</u>	<u>137</u>	<u>137</u>	<u>141</u>	<u>141</u>	<u>141</u>	<u>141</u>	<u>141</u>
Sales of Coal	th. tons	750	780	912	915	914	944	944	979	979	979	979	979
<u>Direct Mining Costs</u>	pesos per ton raw coal												
Wages & Salaries		3411	3387	3015	2817	2631	2220	2236	2196	2211	2227	2242	2258
Other		<u>1918</u>	<u>2091</u>	<u>1917</u>	<u>1862</u>	<u>1951</u>	<u>1910</u>	<u>1910</u>	<u>1905</u>	<u>1905</u>	<u>1905</u>	<u>1905</u>	<u>1905</u>
Total Direct Costs		5329	5478	4932	4679	4582	4130	4146	4101	4116	4132	4147	4163
<u>Indirect Mining Costs</u>													
Wages & Salaries		495	486	416	412	412	404	407	400	403	406	409	412
Depreciation & Depletion		282	506	649	817	936	967	972	948	948	948	948	948
Provisions for Future Development		--	--	--	--	--	133	133	133	133	133	133	133
Other		<u>1508</u>	<u>1459</u>	<u>1282</u>	<u>1258</u>	<u>1243</u>	<u>1199</u>	<u>1184</u>	<u>1162</u>	<u>1158</u>	<u>1145</u>	<u>1145</u>	<u>1145</u>
Total Indirect Costs		2282	2451	2347	2487	2591	2703	2696	2643	2642	2632	2635	2638
Total Mining Costs	pesos per ton raw coal	7611	7929	7279	7166	7173	6833	6842	6744	6758	6764	6782	6801
Total Mining Costs	pesos per ton coal sold	8636	8874	8189	8161	8264	7825	7835	7715	7731	7738	7759	7781
Washing & Sales Expense	pesos per ton coal sold	695	695	699	700	401	390	380	380	380	380	380	380
Income Tax (18.1%)	pesos per ton coal sold	105	78	168	262	297	358	329	361	365	371	375	379
Workers' and Executives' Participation	pesos per ton coal sold	50	37	182	216	225	240	235	242	244	246	249	250
Commitment Charges and Bond Interest	pesos per ton coal sold	29	45	29	16	124	292	446	391	350	308	262	215
Special Service Charge to CORFO	pesos per ton coal sold	--	--	--	--	--	3	5	5	6	6	6	7
Total Cost	pesos per ton coal sold	9515	9729	9267	9355	9311	9108	9230	9094	9076	9049	9031	9012
Average Selling Price	pesos per ton coal sold	<u>9288</u>	<u>10081</u>	<u>10081</u>	<u>10081</u>	<u>10657</u>	<u>10726</u>	<u>10726</u>	<u>10726</u>	<u>10726</u>	<u>10726</u>	<u>10726</u>	<u>10726</u>
Net Profit after Taxes	pesos per ton coal sold	473	352	814	726	1346	1618	1496	1632	1650	1675	1695	1714
Total Net Profit	million pesos	355	275	742	664	1230	1527	1412	1598	1615	1640	1659	1678
Net Profit before Bond Interest	million pesos					(1347)	(1818)	(1858)	(1989)	(1965)	(1948)	(1921)	(1893)

Annex 6

Compania Carbonifera e Industrial de Iota

Cash Flow Projections, 1957 - 1968  
(Millions of Pesos)

<u>Fiscal Years Ended Dec. 31</u>	<u>1957</u>	<u>1958</u>	<u>1959</u>	<u>1960</u>	<u>1961</u>	<u>1962</u>	<u>1957- 1962</u>	<u>1963</u>	<u>1964</u>	<u>1965</u>	<u>1966</u>	<u>1967</u>	<u>1968</u>
<u>SOURCES OF FUNDS</u>													
Depreciation and Depletion	240	442	666	830	986	1045	4209	1051	1062	1062	1062	1062	1062
Allocation for development charged to cost	335	453	443	488	310	436	2465	436	436	436	436	436	436
Allocation for accident insurance charged to cost <sup>1/</sup>	15	23	31	39	47	55	210	63	71	71	71	71	71
<u>Net Profits before bond interest, after taxes</u>	<u>355</u>	<u>275</u>	<u>742</u>	<u>664</u>	<u>1347</u>	<u>1818</u>	<u>5201</u>	<u>1858</u>	<u>1989</u>	<u>1965</u>	<u>1948</u>	<u>1921</u>	<u>1893</u>
Company's own generation of funds	945	1193	1882	2021	2690	3354	12085	3408	3558	3534	3517	3490	3462
IBRD loan	1094	1091	1301	1609	679	466	6240	--	--	--	--	--	--
<u>CORFO loan</u>	<u>785</u>	<u>640</u>	<u>300</u>	<u>104</u>	<u>--</u>	<u>--</u>	<u>1829</u>	<u>--</u>	<u>--</u>	<u>--</u>	<u>--</u>	<u>--</u>	<u>--</u>
Total Sources	2824	2924	3483	3734	3369	3820	20154	3408	3558	3534	3517	3490	3462
<u>ALLOCATION OF FUNDS</u>													
Project Investment	1799	2132	2419	2385	949	635	10319	--	--	--	--	--	--
Other Investments	335	221	333	415	483	512	2299	605	613	613	613	1127	1127
Mine Development <sup>2/</sup>	335	453	443	488	310	436	2465	436	436	436	436	436	436
Increase in Net Working Capital	297	60	230	80	100	1068 <sup>3/</sup>	1835	--	70	--	--	--	--
Interest IBRD loan	--	--	--	--	--	176	176	331	303	273	242	208	173
Interest CORFO loan	--	--	--	--	107	99	206	90	80	70	60	49	37
Amortization IBRD loan	--	--	--	--	--	237	237	493	522	551	582	616	651
Amortization CORFO loan	--	--	--	--	138	146	284	154	164	174	185	196	207
Dividends	58	58	58	116	232	304	826	900	900	900	900	900	900
<u>CORFO Participation in Profits</u>	<u>--</u>	<u>--</u>	<u>--</u>	<u>--</u>	<u>--</u>	<u>--</u>	<u>--</u>	<u>--</u>	<u>30</u>	<u>30</u>	<u>30</u>	<u>30</u>	<u>30</u>
Total Allocation	2824	2924	3483	3484	2319	2545	18647	3009	3088	3017	3028	3532	3531
Net Generation of Funds, specified year				250	1050	207	--	399	470	517	489	- 42	- 69
Net Generation of Funds, cumulative				250	1300	1507	--	1906	2376	2893	3382	3340	3271
Debt Service Coverage <sup>4/</sup>								2.72	2.86	2.84	2.82	2.81	2.76

<sup>1/</sup> This covers insurance obligations which would arise in case the mine were to be permanently closed. Since current payments on account of accidents are included in operating costs, these allocations represent a source of funds without a corresponding cash outflow.

<sup>2/</sup> Includes only development expenditure charged to cost totaling 2029 million pesos 1957-1961. That portion of mine development which is capitalized (1278 million pesos 1957-1961) is included in the project investment.

<sup>3/</sup> This increase corresponds to the need for working capital to cover one year's debt service on the IBRD and CORFO loans.

<sup>4/</sup> Times debt service covered by net profits before bond interest and before depreciation and depletion.