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INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT

Public Disclosure Authorized

APPRAISAL OF THE RIO TUMA HYDROELECTRIC PROJECT

NICARAGUA

June 8, 1960

Department of Technical Operations

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Currency Equivalents

| | | |
|----------------|---|---------------------|
| U.S. \$ 1 | - | 7 Cordobas (C \$ 7) |
| C \$ 1 | - | U.S. 14 cents |
| C \$ 1 million | - | U.S. \$ 142,857 |

APPRAISAL OF THE RIO TUMA HYDROELECTRIC PROJECT - NICARAGUA

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APPRAISAL OF THE RIO TUMA HYDROELECTRIC PROJECT - NICARAGUA

SUMMARY

- i. This report covers the appraisal of the Rio Tuma hydroelectric project which has been proposed as the basis for a Bank loan of \$12.5 million equivalent.
- ii. The loan would be made to the Empresa Nacional de Luz y Fuerza, a corporation wholly owned by the Government of Nicaragua.
- iii. The Empresa has at present a total generating capacity of 38 MW and sells energy at retail in Managua and the surrounding area through its own distribution system. It also owns and operates the only transmission system in Nicaragua and sells power on a wholesale basis to 14 municipal and private power companies in major urban centers of the country.
- iv. The Bank has previously made four loans in Nicaragua for the expansion and improvement of power facilities. The first made in 1953 amounted to \$450,000 equivalent. The other three made in 1955 and 1956 totalled \$9.10 million equivalent. A small amount remains to be disbursed under the last loan.
- v. A new power source will be necessary by mid-1965 to meet expected increases in power demand within the service area. The proposed hydro development appears to be the most suitable method of providing that source.
- vi. The proposed project consists of a rock fill dam on the Tuma River some 120 km north-east of Managua, and a power station providing additional 50 MW of generating capacity at a cost of \$387 per kw (including transmission facilities). The total estimated cost of the project, providing also for a further expansion of Empresa's distribution system and various minor items, is equivalent to \$20.8 million, with interest during construction capitalized.
- vii. The project has been designed by competent engineering consultants who would be retained to continue detailed design and the engineering supervision of construction.
- viii. The construction of the project is scheduled to start in late 1960 and to be completed in 1965. This is realistic.
- ix. The Empresa operated at a deficit during the fiscal year ending June 30, 1959 after a reduction in electricity rates in October 1958. This situation continued through the first half of fiscal year 1960. In November 1959 a rate increase was put in effect which despite slight modification in February 1960 should be sufficient to generate out of surpluses approximately 20% of the project cost during the construction period after provision for all operating expenses and adequate depreciation charges.

x. For the financing of the local currency cost of the Project the Empresa has obtained a \$2.5 million loan from DLF and commitments from the Nicaraguan Government amounting to \$1.15 million equivalent. The government will also provide additional funds to strengthen the Empresa's financial position during the construction period.

xi. Financial forecasts show that the Empresa would be able in the future to maintain a sound financial position and that debt service would be adequately covered.

xii. The project would be suitable for a loan of \$12.5 million equivalent for a term of 25 years, including a period of grace of approximately 5 years on amortization payments.

APPRAISAL OF THE RIO TUMA HYDROELECTRIC PROJECT - NICARAGUA

I. INTRODUCTION

1. This report covers an appraisal of the Rio Tuma hydroelectric plant (Centroamerica plant) and associated transmission lines and other related facilities. This project is estimated to cost the equivalent of \$20.8 million. The Bank has been asked to consider a loan to cover the foreign exchange cost of the project, estimated to be the equivalent of \$12.5 million.

2. Project design and planning have been carried out by "Electroconsult" of Milan, Italy, in conjunction with the Comision Nacional de Energia (CNE), an agency of the Nicaraguan Government responsible for development of the country's power resources. This report is based on data furnished by the Government to Bank missions which visited Nicaragua in February and November 1959 and on revised data supplied during discussions in Washington in April 1960.

3. The Borrower would be the Empresa Nacional de Luz y Fuerza, a government owned power corporation which serves the major population centers of the country from a central station located in Managua, the capital city.

4. The Bank has previously made four loans for power development in Nicaragua. The first was made in 1953 for a 3 MW diesel unit in the Empresa's existing power station in Managua. This unit was to provide needed capacity pending the construction of a 30 MW steam plant by the Empresa. The other loans were for this steam plant, transmission lines to serve 14 towns and improvements in the distribution systems in Managua and the 14 towns served by the transmission network. The amounts of the loans and other pertinent data are as follows:

| <u>Loan</u> | <u>Amount</u> (in millions \$) | <u>Term</u> (years) | <u>Borrower</u> | <u>Facilities</u> |
|---------------|-----------------------------------|------------------------|-------------------------|----------------------------------------------------------------------------|
| 82 NI (1953) | 0.45 | 10 | The Government | 3 MW diesel unit |
| 121 NI (1955) | 7.10 | 20 | The Empresa | 30 MW steam plant, transmission lines and distribution in Managua |
| 122 NI (1955) | 0.40 | 20 | Instituto de Fomento | Distribution in 14 towns |
| 154 NI (1956) | 1.60 | 15 | The Empresa | Supplemental to 121 NI. ^{1/} |

^{1/}Although the total cost of the project remained approximately unchanged, the foreign exchange component was underestimated by the amount of the supplemental loan.

All loans were at 4-3/4% interest. The generating plants and transmission and distribution system have all been completed and put in operation. The proposed project would be interconnected with this system.

II. THE BORROWER

Organization and Management

5. The Empresa Nacional de Luz y Fuerza was established by decree^{1/} in October 1954 as an autonomous public corporation. Prior to this time it had been administered by the Ministerio de Fomento (1953) and the State Railways (1941-1952).

6. The policies of the Company are established by a Board of Directors consisting of three members appointed by the President of Nicaragua. The Company is administered by a General Manager, appointed by the Board.

7. The present Chairman of the Board, who devotes his full time to the affairs of the Empresa, and the General Manager have recently been appointed to their positions. While able administrators, they have had no previous experience in the operation of a power utility system. With the substantial expansion of the system now contemplated, the staff of the Company and the management would need to be strengthened by experienced advisors.

8. Upon the Bank's suggestion, the Empresa agreed to engage an experienced management consulting firm to study and make specific recommendations to improve its organization and to achieve more efficient operation. The consultants would also assist in recruiting additional key staff members and advisors which may be required.

9. The Empresa's annual accounts are at present not being audited by independent accountants. The Company intends to have this done in the future.

Existing Installations

10. Until 1958, the Empresa supplied power with diesel units only to Managua and to two small isolated communities. The diesel units installed in the Managua generating plant had a total capacity of 10,250 kw but because of age and lack of maintenance, the effective capacity was only 8000 kw.

11. The Managua steam plant with two 15,000 kw units came into operation in 1958, increasing the total effective generating capacity to 38,000 kw. At the same time 175 kilometers of 69 kv and 95 kilometers of 13.2 kv transmission lines were completed, connecting an additional 14 communities to Empresa's system. Some of these towns have standby diesel units with a total capacity of 3,300 kw.

^{1/}Decrees have the full force and effect of law.

12. The Empresa serves at present about 68% of the urban population of Nicaragua. In Managua and surrounding area it owns and operates the distribution system. In the 14 towns supplied by the transmission network, it sells power wholesale to retail distributors.

III. THE POWER MARKET

Past Sales by Empresa

13. Empresa's annual retail power sales increased from 7.14 million kwh to 51.5 million kwh between 1946 and 1959. The average rate of growth in sales has been more than 16% compounded annually for the 13 year period. Data are not available for past growth of load of the utilities to which since 1958 the Empresa has supplied electricity in bulk. These wholesale supplies by Empresa amounted to 3.6 million kwh in the last 3 months of 1958 and 18.3 million kwh in 1959.

14. Residential sales have been the largest factor in past growth of retail supplies. They increased at the average rate of 19% compounded annually over the 13 year period and represented 49% of total retail sales in 1959. Industrial sales increased at an annual rate of 12.5% and represented 22% of sales in 1959.

Past Retail Sales by Class of Consumer (calendar years - in millions of kwh)

| <u>Calendar</u> <u>Year</u> | <u>Residential</u> <u>Sales</u> | <u>%</u> | <u>Industrial</u> <u>Sales</u> | <u>%</u> | <u>Other</u> <u>Sales</u> | <u>%</u> | <u>Total</u> | <u>Increase</u> <u>(%)</u> |
|--------------------------------|------------------------------------|----------|-----------------------------------|----------|------------------------------|----------|---------------------|-------------------------------|
| 1946 | 2.62 | 37 | 2.51 | 35 | 2.01 | 28 | 7.14 | (1946 - 1954: |
| 1954 | 10.48 | 41 | 10.76 | 42 | 4.20 | 17 | 25.44 | 17.3% average) |
| 1955 | 12.68 | 42 | 12.28 | 41 | 4.90 | 17 | 29.86 | 17 |
| 1956 | 15.06 | 45 | 12.35 | 37 | 5.86 | 18 | 33.27 | 11 |
| 1957 | 16.43 | 46 | 13.06 | 36 | 6.46 | 18 | 35.95 | 8 |
| 1958 | 19.05 | 48 | 11.54 ^{2/} | 29 | 13.21 | 33 | 40.20 ^{1/} | 12 |
| 1959 | 25.08 | 49 | 11.55 | 22 | 14.86 | 29 | 51.49 ^{1/} | 28 |

15. At various times in the past before the new plant came into operation, the Empresa has been forced to restrict services during peak hours to confine system demand to the capacity of the generation facilities. In addition, the larger industrial loads were required to be shut down between the hours of 5 p.m. and 4 a.m. The peak load which had grown from 3,500 kw in 1950 to 8,400 kw in 1957 jumped to 20,200 kw in 1959 when the Empresa started supplying other distributors on a wholesale basis. The load carried by Empresa's facilities was close to the available capacity except for short periods after installation of new generating units when a reasonable reserve existed.

^{1/}Excludes wholesale sales of 3.6 million and 18.3 million kwh in 1958 and 1959 respectively.

^{2/}A change in classification was mainly responsible for this decrease in industrial sales.

Past Load and Capacity
(in megawatts)

| <u>Calendar</u> <u>Year</u> | <u>Peak Load</u> | <u>Installed Capacity</u> ^{1/} | <u>Annual Load Factor (%)</u> |
|--------------------------------|------------------|-----------------------------------------|-------------------------------|
| 1950 | 3.5 | 4.3 | 47 |
| 1951 | 3.5 | 4.3 | 52 |
| 1952 | 4.3 | 4.3 | 47 |
| 1953 | 5.4 | 7.3 | 47 |
| 1954 | 6.8 | 10.3 ^{2/} | 50 |
| 1955 | 7.2 | 10.3 ^{2/} | 55 |
| 1956 | 7.5 | 10.3 ^{2/} | 58 |
| 1957 | 8.4 | 10.3 | 59 |
| 1958 | 18.4 | 40.3 | 37 |
| 1959 | 20.2 | 40.3 | 51 |

Forecast Sales, Load and Capacity^{3/}

16. A power market study of the area served by the Company was prepared in 1958 by Electroconsult, the Italian consulting firm retained to study the Rio Tuma project. It showed that power requirements could be expected to increase rapidly but it assumed an earlier completion of the new thermal plant than actually accomplished. As a result of this, the actual sales of energy and peak demand have been lower than forecast in the study.

17. Total Sales in fiscal year 1959 amounted to 60.7 million kwh including 12.6 million kwh sold wholesale. It is reasonable to expect, based on sales of 49.2 million kwh during the first eight months of the fiscal year 1960, that total sales will reach 75 million kwh, representing an increase of 23%.

18. For later years, the estimated increase in power consumption in Managua is expected to be the result of: (a) the effect of connecting new major loads which have already specifically been planned, and (b) a continuation of growth of the residential and commercial load, but over the period 1960-1969 an annual average rate of 10% was assumed more realistic than the 15% forecast by the consultants.

19. Outside Managua records are inadequate to provide a guide to past trends and in addition the secondary distribution systems of the 14 towns, until renovated, will limit normal load growth. In the circumstances, consumption has been estimated to increase at an annual rate of 10% but this rate could easily be exceeded when the planned improvements to the distribution networks are completed. Details of the sales forecasts are shown in Annex 1.

^{1/}Installed capacity is the total nameplate rating of generating units.

^{2/}Effective capacity was limited to 8.4 M.W.

^{3/}Sales and load estimates in the following report are based on the year ending June 30 to be consistent with the Empresa's fiscal year and the financial forecasts.

20. The estimated demand on the existing system, as shown in Annex 2 and plotted graphically in Annex 3, is expected to increase from 22,600 kw in 1960 to 50,000 in 1969. This takes into consideration an expected improvement of the system load factor and decreasing system losses which at present amount to about 18% of all energy generated.

21. As shown in Annex 3, the existing generating capacity would be sufficient to meet the expected demands until the Rio Tuma hydro plant comes into operation in 1965. During a part of this period an adequate reserve capacity would not be available in the system but the provision of additional generating plant would be beyond the financial capacity of the Empresa.

22. In the years after 1965, the new hydro capacity would be operated to meet the base load of the system and the steam thermal plant would be kept as reserve. The diesel plant could be retired or kept as standby. The second stage of the hydro development with a capacity of 17,000 kw will be required by 1968 if the hydro system should continue to carry the base load.

IV. THE PROJECT

General

23. The firm Electroconsult was engaged by the Empresa in 1957 to study the possibilities for developing the hydroelectric potential of the Rio Tuma and prepare the design and cost estimates of the first stage of the development. The studies showed that the most attractive solution would be to divert the water from the upper part of Rio Tuma, which discharges into the Atlantic, into the Rio Viejo which flows into the Lake Managua (see map attached). This would permit the construction, at reasonable costs, of a series of five generating plants along the Rio Viejo valley with a total capacity of more than 250 MW; sufficient to meet the increase in power demand of the Empresa system for a long period.

Rio Tuma (Centroamerica) Plant

24. The first stage of the development is the 50 MW plant on the Rio Cacao and associated transmission line now proposed for Bank financing. It is located some 120 kilometers north-east of Managua. In this stage a 46 meter high rockfill dam would be built on the Rio Tuma to create a reservoir with a gross storage capacity of 410 million cu. meters. Water would be diverted from the upstream end of the reservoir through a 6.7 kilometer intake canal and tunnel, and a 676 meter long penstock to a powerhouse on the Rio Cacao (a tributary of the Rio Viejo) equipped with two 25 MW turbine generator units. An outdoor substation, 120 kilometers of 137 kv transmission line to a receiving substation at Managua would also be constructed. A map at the end of this report shows the geographic location of the main items of the project. (A detailed description is given in Annex 4).

25. Stream flow records for the Rio Tuma are available for only a seven year period but they are supplemented by 15 years of rainfall data and a good correlation was obtained. On the basis of these records the average flow at the dam site was estimated at 10.5 cu. meters/sec. This would permit an average annual output of the plant of 187 million kwh with a load factor of 43%.

26. The useful storage capacity of the reservoir would be 250 million cu. meters, leaving a substantial dead storage. Studies show that siltation of the reservoir would not present any problems.

27. The design flood was estimated at 4,700 cu. meters/sec, or about four times the highest flood which appears to have occurred. The dam is designed to permit a 2.5 meter rise in water level above the maximum operating level and still leave 2.5 meters of free board. By routing the peak flood through the reservoir, calculations show that, with the flow duration characteristic assumed, a spillway capacity of 1400 cu. meters/sec would be required and has been provided for.

Engineering and Planning

28. The Empresa intends to continue to use the services of Electroconsult to prepare the detailed plans and specifications for the Rio Tuma plant. Geological studies have been carried out by an experienced French consultant and they show in general favorable conditions for foundations and tunneling. The design of the project is sound.

Construction

29. To manage the execution of the project, the Empresa has agreed to establish a Construction Department and recruit an experienced construction engineer as an advisor to the Chief of this Department. They would be assisted by Electroconsult, which will be responsible for the supervision of all construction work. Bids for the civil works as well as major electrical and mechanical equipment will be invited on an international basis from qualified contractors and suppliers. The civil works contractors would be mutually satisfactory to the Empresa and the Bank.

Schedule of Construction

30. The construction of the Rio Tuma plant is estimated to require about four years with the two generating units coming into operation in May and October 1965 respectively assuming that contracts are let early in 1961 for the civil works. A detailed schedule is shown in Annex 6.

Other Works

31. In addition to the Rio Tuma plant, the project proposed for Bank financing would include necessary expansion of the Managua distribution network and a new main office building. Transportation and communication equipment required for the maintenance of the transmission system would also be financed by the proposed loan.

Cost Estimates

32. The estimated cost of the principal items in the project are shown in the following table (a detailed breakdown is given in Annex 5):

| <u>Item</u> | <u>Foreign Exchange</u> | <u>Local Currency</u> | <u>Total</u> |
|------------------------------|-----------------------------|-----------------------|----------------|
| | (in thousands U.S. dollars) | | |
| Rio Tuma plant | 6,725.4 | 3,675.7 | 10,401.1 |
| Transmission and substations | 2,285.5 | 740.4 | 3,025.9 |
| Contingencies | 1,690.5 | 733.5 | 2,424.0 |
| Engineering | <u>920.6</u> | <u>471.4</u> | <u>1,392.0</u> |
| Subtotal | 11,622.0 | 5,621.0 | 17,243.0 |
| Main office building | 175.0 | 250.0 | 425.0 |
| Maintenance equipment | 90.0 | - | 90.0 |
| Distribution materials | 313.0 | - | 313.0 |
| Management consultants | <u>300.0</u> | <u>150.0</u> | <u>450.0</u> |
| Subtotal | 878.0 | 400.0 | 1,278.0 |
| Total project cost | 12,500.0 | 6,021.0 | 18,521.0 |
| Interest during construction | <u>1,979.0</u> | <u>281.0</u> | <u>2,260.0</u> |
| Total | 14,479.0 | 6,302.0 | 20,781.0 |

33. The approximate rate of expenditure is expected to be as follows:

| | <u>1961</u> | <u>1962</u> | <u>1963</u> | <u>1964</u> | <u>1965</u> | <u>Total</u> |
|------------------|---------------------|-------------|-------------|-------------|-------------|--------------|
| | (millions of US \$) | | | | | |
| Foreign exchange | 1.7 | 2.5 | 3.3 | 4.2 | 2.8 | 14.5 |
| Local currency | <u>1.0</u> | <u>1.8</u> | <u>1.2</u> | <u>1.5</u> | <u>0.8</u> | <u>6.3</u> |
| | 2.7 | 4.3 | 4.5 | 5.7 | 3.6 | 20.8 |

34. The estimates are based on current international prices and on the assumption that all materials and equipment would be admitted free of duty. Unit costs have been checked against Nicaraguan experience with highway construction contracts and adjusted where necessary. The cost of civil works includes access road, land clearing, the construction camp and permanent operator's facilities. Contingencies on the Rio Tuma plant amount to about 18% of construction costs. The estimates are realistic.

35. The unit cost of the Rio Tuma plant including transmission facilities and interest during construction would amount to \$387/kw. This is a reasonable cost, in particular taking into account that the regulating reservoir would in the future also serve the plants to be constructed further downstream on the Viejo river. The cost of power from the Rio Tuma plant, delivered at Managua, is estimated on a commercial basis at 8.4 U.S. mills/kwh.

V. ECONOMIC ASPECTS

36. The alternative to the construction of the Rio Tuma plant would be the addition of an adequate amount of thermal plant capacity which would meet the same peak load and energy demand assumed for the proposed Rio Tuma project.

37. It has been assumed that in the event of the adoption of the thermal alternative a 30 MW steam plant would be installed near the port of Corinto in the north-western part of the country, as this seems to be the best technical and economic solution. Among other factors this would effect a sizable reduction in overland transportation costs for equipment and fuel. There would be required a 138 kv connection between the new plant and Managua. The initial capital cost of this line (about \$3 million) would be justified since annual costs involved would be exceeded within 4 or 5 years by the difference in fuel cost for a corresponding plant at Managua. As Rio Tuma would start operation only in 1966, in order for the comparison to be significant it is also assumed that the thermal plant is put in operation in 1966 even though this may involve a short term limitation on system capacity. The addition of a third 15 MW unit has been assumed for 1969.

38. On this basis a comparison of total cash outlays has been made using the present worth method at 8% interest (Annex 7). The total cash expenditures for both alternatives are calculated over a period of 12 years through 1971 at which point the two systems would be fully loaded and a further expansion would be required. The present worth of the total cash outlays for the hydro alternative (construction and operation of the Rio Tuma project, and operation of existing steam and diesel capacity at Managua) amounts to about \$22.3 million. The corresponding expenditures for the construction and operation of the alternative thermal scheme total about \$21.0 million.

39. Considering the approximations in the assumptions made, the present worth calculation shows that the total cash outlay for the period under review would be roughly equal in either alternative.

40. After 1971 the expansion of the hydro up to the installation of a total of 250 MW could be accomplished more economically than a thermal alternative because part of the civil works now planned for the Rio Tuma project can be utilized for later downstream extensions. Operating costs of the hydro system would continue to be considerably lower than those for a thermal system.

41. The operation of the thermal alternative would depend on imported fuel. The construction of the hydro, therefore would also result in considerable savings in foreign exchange. In 1969 when the full thermal alternative capacity of 45 MW is installed, the savings in foreign exchange for imported fuel would roughly amount to \$1,000,000.^{1/}

^{1/} After adjustments for debt service and the small thermal component of the hydro system.

42. A separate and distinct comparison has been made between the proposed hydro project and a thermal plant of the same capacity (50 MW). The savings in annual operating costs of the proposed hydro scheme represent a return of about 18% on the additional investment required for the construction of the Rio Tuma project (Annex 7a).

43. It should be noted that in the comparisons made the hydroelectric alternative has not been given any credit for the possible utilization of the regulated flow of the Rio Viejo for irrigation purposes which was provided for in the general plan of Electroconsult. Preliminary studies indicate that an area of some 30,000 hectares, partly in the Sebaco plain and partly along Lake Managua, could be served and that conditions are favorable for a substantial increase in agricultural production.

44. In the circumstances the construction of the project is justified and preferable to the thermal alternative.

VI. FINANCIAL ASPECTS

Power Rates

45. Electricity rates are regulated by the Comision Nacional de Energia. Before October 1958, the Empresa had established rates at a level, which on the average yielded 4.9 US cents per kwh. At that time the Comision put into effect a new tariff structure which drastically reduced and also standardized the rates charged by the Empresa and the retail companies in the 14 towns supplied by the Empresa. The reduced rates resulted in a reduction of the average revenue per kwh received by the Empresa by about 40% to about 3.0 US cents/kwh.

46. As a result of this reduction the Empresa operated during fiscal year 1959 at a deficit, which would have continued for a number of years. This unsatisfactory development had not been anticipated by the Comision and it was clearly inconsistent with the undertaking given to the Bank in connection with Loan No. 121 NI which specified that the rates charged by the Empresa would provide revenues sufficient to: (a) cover operating expenses, including maintenance, depreciation, taxes and interest; (b) meet repayments on long-term indebtedness but only to the extent that such repayments exceed provisions for depreciation; and (c) provide a reasonable surplus for financing new investments^{1/}.

^{1/} This rate covenant is also included in the Loan Agreement for the proposed new loan.

47. A rate increase was therefore authorized by the Comision in November 1959 and is estimated to result in an average revenue of US 4.2 cents/kwh equivalent. The revised rates are expected to eliminate the existing cumulative deficit by 1962 and to provide revenues sufficient to permit the Empresa to finance approximately 20% of the total cost of the proposed project after provision for all operating expenses and adequate depreciation. This is satisfactory.

Past Earnings Record

48. The Empresa had reasonably satisfactory earnings from power operations before October 1958. Condensed income statements for the fiscal years 1954 through 1959 and for eight months of fiscal year 1960 are shown in Annex 10. Figures are expressed in US dollar equivalents. During the period 1954-56, gross revenue increased from \$1.1 million to \$1.6 million, or 45%. Net income from operations was \$164,000 in 1954 and \$342,000 in 1956, representing a return on the net fixed assets in operation of 10% and 12.7% respectively. Net income after interest charges amounted to \$133,000 in 1954 and \$304,000 in 1956. The return after 1956 has not, however, kept pace with the growth of the Company. Gross revenue has continued the increase to \$1.9 million by 1958, an additional 20%. However, net income from operations declined to \$257,000 in 1958 and \$229,000 after interest charges. The return on net fixed assets in operation declined to 8.7% and to a return of 2.0% on net fixed assets including work in progress. After tariffs were reduced on October 1, 1958, a deficit developed, amounting to \$642,000 in 1959. The deficit for 1960 has been reduced since to \$177,000 (8 months to February 29, 1960).

Financial Position

49. These losses resulted in a marked decrease of the Empresa's capital resources in fiscal year 1959 and the 8 months of 1960. At the same time the available working capital was diminished by a relatively high percentage of delinquent accounts receivable. Under these circumstances the government had to advance sizable amounts to the Empresa in order to enable the company to meet its obligations. Previous government loans also helped to finance the construction of Empresa's thermal plant in Managua. The Loan Agreement for this project (Loan 121 NI) specified that service on the government loans and advances would be junior to all other obligations of the Empresa and that for the purpose of calculating the debt/equity ratio these contributions would be considered as equity. With regard to the delinquent accounts receivable the government has paid all its overdue bills, and the Empresa will furnish within a specified time a plan satisfactory to the Bank outlining measures taken or to be taken to ensure prompt payment of accounts.

50. Mainly because of these government contributions the Empresa's balance sheet position is reasonably sound. The debt/equity ratio at the end of fiscal year 1959 was 64/36. Most of the debt is long term. Fixed assets in operation are carried on the books at realistic values. Average depreciation charge on existing properties has been about 3½% on a straight line basis. Condensed balance sheets of Empresa as of June 30, 1954-59 inclusive, and as of February 29, 1960 are given in Annex 9.

1/A ratio of not more than 2:1 was agreed upon and the same covenant is included in the loan agreement for the proposed project.

51. Capitalization as of February 29, 1960, is summarized below:

(in millions of dollars)

| | | |
|---------------------|------------|-----|
| Fixed capital | 1.4 | |
| Capital Surplus | <u>0.5</u> | |
| Total | 1.9 | |
| Government Advances | <u>3.2</u> | |
| Total Equity | | 5.1 |

Long-Term Debt:

| | | |
|-------------------------------------------------------------------------------|------------|------------|
| Export-Import Bank 4% of 1951 due 1962 | 0.2 | |
| Export-Import Bank 5-3/4% of 1959 due 1970 \$475,000 (no withdrawals made) | - | |
| IBRD Loan 82 NI 4-3/4% of 1952 due 1963 | 0.2 | |
| IBRD Loan 121 NI 4-3/4% of 1955 due 1975 | 6.7 | |
| IBRD Loan 154 NI 4-3/4% of 1956 due 1962 | 1.2 | |
| National Bank 6% of 1959 due 1962 | <u>0.4</u> | |
| Total Indebtedness | | <u>8.7</u> |
| Total Capitalization | | 13.8 |
| Debt/Equity Ratio | | 63/37 |

52. In 1955 the Government agreed to advance to the Empresa up to \$3.1 million equivalent to provide local currency required for the construction of the Managua thermal plant and related transmission facilities. For the completion of this project a total of about \$2.8 million was used.

53. During fiscal year 1960 the government has made available to Empresa additional funds totalling about \$0.7 million increasing the total contribution to about \$3.5 million equivalent up to April 1960. It is agreed that this contribution will be converted into equity.

Financial Forecasts

54. Income statements, cash flows and balance sheets as shown in Annexes 11, 12 and 13, have been based on the increased rates established in November 1959 taking into account a small adjustment made in February 1960. An understanding has been reached with the Empresa that proposed changes in the present rate structure affecting the level of revenues will be brought to the Bank's attention for consultation prior to any action on the changes.

55. It has been assumed in the forecasts that:

- (a) The sales would increase from 75 million kwh in fiscal year 1960 to 188 million kwh in 1969.

- (b) The average revenue per kwh would be US cents 3.85 for fiscal year 1960 and US cents 4.19 in 1961. For later years adjustments have been made for expected changes in relative consumption of major categories of consumers.
- (c) Depreciation of the Rio Tuma plant would be on a straight line basis at the rate of 2.5% per annum.
- (d) Interest during construction would be capitalized.

56. On the basis of these assumptions the total cost of the project estimated at 20.78 million equivalent would be financed as follows:

| | <u>Millions \$</u> | <u>%</u> |
|------------------------------------------------------------------------|--------------------|------------|
| Proposed Bank Loan | 12.50 | 60 |
| Proposed DLF Loan | 2.50 | 12 |
| Government contribution to the project | 1.15 ^{1/} | 6 |
| Government contribution to strengthen the Empresa's financial position | 0.65 ^{1/} | 3 |
| Retained earnings | 4.37 | 21 |
| Less: Increase in Working Capital | <u>(0.39)</u> | <u>(2)</u> |
| Total | 20.78 | 100 |

57. The proposed Bank loan ^{2/} would finance the estimated foreign exchange cost of the project excluding interest during construction.

58. For the loan of \$2.5 million, which Empresa has obtained from DLF, a term of 20 years and an interest rate of 3.5% has been arranged. It is understood that withdrawals from the loan would be made in proportion to the payment of the government contribution of \$1.15 million to the project to assure that the debt/equity ratio of the Company would not exceed the ratio of 2:1 which is specified in the Loan Agreement for the proposed loan.

59. The additional government contribution of \$0.65 million is designed to improve Empresa's financial position during 1960/61 and to provide for reasonable working capital during the construction period.

60. The long-range financial position of the Empresa under this financing plan will be reasonably sound and can be summarized as follows:

- (a) By 1961 the Empresa would again show a profit and would have generated by the end of 1965, approximately 20% of the total cost of the project, out of surpluses after providing for all operating expenses and adequate depreciation.

^{1/} Considered as equity contribution (see page 9).

^{2/} An interest rate of 6% has been assumed for calculation purposes.

- (b) Net income from operations, after depreciation but before interest charges would increase from ₱366,000 in 1960 to ₱1.9 million in 1965 and ₱4.3 million in 1969, which would represent a return on net fixed assets excluding work in progress of 2.6% in 1960, 6.7% in 1961, 13.7% in 1965 and 15.1% in 1969.
- (c) Between 1967 and 1969 the Empresa would be able to finance through retained earnings further expansion of its system including the next step of the planned hydro development estimated at a total cost of ₱5.0 million.
- (d) Cash generated from operations would cover debt service (excluding capitalized interest during construction) only partly in 1960, 1.3 times in 1961, 2.9 times in 1965, dropping to 1.9 times in 1966 after full debt service on the proposed IBRD and DLF loans is assumed, and reaching 2.5 times again in 1969.
- (e) The debt/equity ratio, based on estimated disbursement of incurred debt would be 62/38 in 1961, 64/37 in 1964, 63/37 in 1965 and 42/58 in 1969.

VII. CONCLUSIONS

61. The project proposed for Bank financing is technically sound and adequate arrangements have been made for its execution. The new generating capacity to be provided by the Rio Tuma hydro plant is required to meet the increasing demand for power in the area served by the Empresa. The cost of the project is reasonable. The present rates charged by Empresa for sale of power should be sufficient to yield reasonable earnings during the next few years.

62. The project would be suitable for a loan of ₱12.5 million equivalent for a term of 25 years, including a period of grace of approximately 5 years on amortization of payments.

ANNEX 1

ESTIMATED ENERGY SALES

| <u>Year</u> | <u>Sales (millions kwh)</u> | | | <u>Percentage Sales Increase</u> |
|-----------------------|-----------------------------|--------------------|--------------|--------------------------------------|
| | <u>Retail</u> | <u>Wholesale</u> | <u>Total</u> | |
| 1957/58 | 37.5 | - | 37.5 | - |
| 1958/59 (actual) | 48.1 | 12.6 ^{1/} | 60.7 | 62 |
| 1959/60 ^{2/} | 55.8 | 19.2 | 75.0 | 23 |
| 1960/61 | 62.9 | 21.1 | 84.0 | 12 |
| 1961/62 | 72.0 | 22.5 | 94.5 | 12 |
| 1962/63 | 82.0 | 24.8 | 106.8 | 13 |
| 1963/64 | 93.5 | 27.3 | 120.8 | 13 |
| 1964/65 | 103.6 | 30.0 | 133.6 | 11 |
| 1965/66 | 115.5 | 33.0 | 148.5 | 11 |
| 1966/67 | 125.7 | 36.3 | 162.0 | 9 |
| 1967/68 | 135.1 | 39.9 | 175.0 | 8 |
| 1968/69 | 144.1 | 43.9 | 188.0 | 7 |

^{1/} Nine months only. First wholesale sales were in October 1958.

^{2/} Based on sales for first eight months of fiscal year.

ESTIMATED SYSTEM DEMAND^{1/} AND CAPACITY

| <u>Year</u> | <u>Gross^{2/} Generation (millions kwh)</u> | <u>Annual Load Factor (%)</u> | <u>Maximum Demand (MW)</u> | <u>Effective Capacity (MW)</u> | <u>Reserve Capacity (MW)</u> |
|-------------|-------------------------------------------------------------|-------------------------------------------|------------------------------------|----------------------------------------|--------------------------------------|
| 1957/58 | 47.34 | 64 ^{3/} | 8.4 | 8.4 | - |
| 1958/59 | 76.0 | 46 | 18.6 | 38 | 19.4 |
| (actual) | | | | | |
| 1959/60 | 90.8 | 46 | 22.6 | 38 | 15.4 |
| 1960/61 | 101.0 | 46 | 25.0 | 38 | 13.0 |
| 1961/62 | 114.0 | 46 | 28.3 | 38 | 9.7 |
| 1962/63 | 126.3 | 47 | 30.7 | 38 | 7.3 |
| 1963/64 | 141.0 | 47 | 34.2 | 38 | 3.8 |
| 1964/65 | 153.0 | 48 | 36.4 | 38 | 1.6 |
| 1965/66 | 171.0 | 48 | 40.7 | 88 ^{4/} | 47.3 ^{5/} |
| 1966/67 | 183.0 | 48 | 43.5 | 88 | 44.5 |
| 1967/68 | 198.0 | 48 | 47.1 | 88 | 40.9 |
| 1968/69 | 210.0 | 48 | 50.0 | 88 | 38.0 |

^{1/} Demand is referred to the system as seen at Managua.

^{2/} Losses introduced by incoming transmission from Tuma are not included.

^{3/} Peak hour load shedding resulted in high annual load factor prior to completion of steam units.

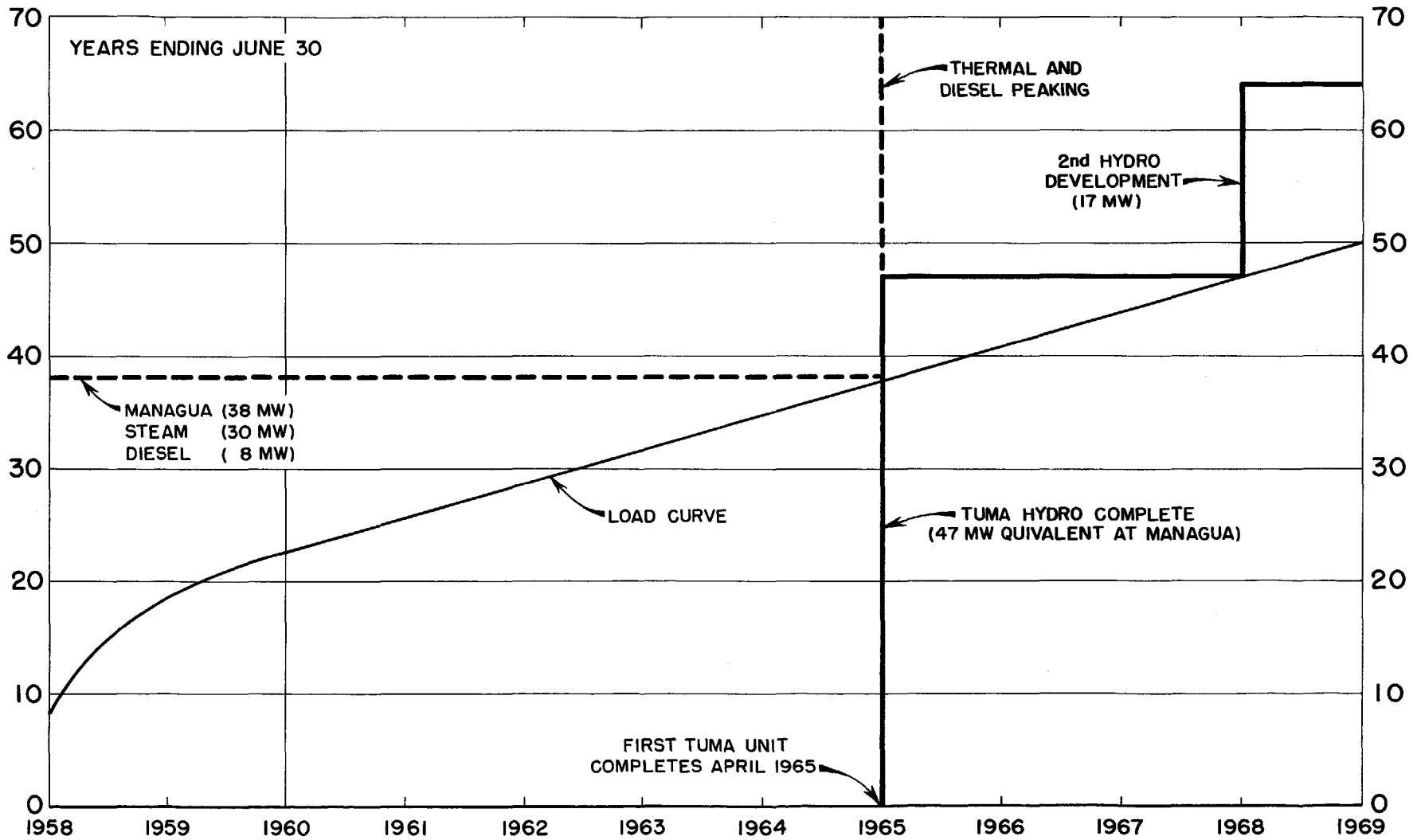
^{4/} Tuma complete.

^{5/} Including 38 MW of thermal capacity.

NICARAGUA: LOAD AND CAPACITY DEVELOPMENT

EMPRESA NACIONAL DE LUZ Y FUERZA

(MEGAWATTS)



DETAILED DESCRIPTION OF THE PROJECT

1. The project is located about 20 km northwest of Jinotega, in turn about 120 km (transmission line distance) in a northerly direction from Managua. Water which normally flows to the Caribbean will be stored in the upper Rio Tuma catchment and diverted to the Pacific Slope. The reservoir when full will be 956 meters above sea level. Power will be developed through a gross head of 277 meters.

Hydrology

2. Records of rainfall, temperature, evaporation, wind velocities and river discharge were available since 1952 from several stations within the project area. Pluviometric data of other stations located outside the project area were available for longer periods (since 1943) and were used to extrapolate a 15 year water cycle. Flow conditions for the selected reservoir and dam site were interpolated from records of gauging stations located both up and downstream and from those of rainfall stations having overlapping catchment areas within the run-off area of the reservoir.

3. Data from the following stations were used:

| <u>Gauging Stations</u> | <u>River</u> | <u>Since</u> |
|--------------------------------|----------------------|--------------|
| Jinotega | Tuma | June 1952 |
| Yacica | " | " " |
| El Dorado | " | May 1952 |
| Mancotal | " | March 1952 |
| <u>Rainfall Stations</u> | <u>Elevation (m)</u> | <u>Since</u> |
| La Reina | 800 | January 1952 |
| Carretera | 900 | March 1952 |
| Coronto-Finca | 1,100 | " " |
| San Rafael | 1,500 | " " |
| Jinotega | 1,000 | April 1952 |
| La Sirena | 550 | January 1954 |
| San Francisco | 900 | 1943 |
| <u>Meteorological Stations</u> | <u>Elevation (m)</u> | <u>Since</u> |
| Managua | 40 | October 1953 |
| Sebaco | 450 | July 1953 |
| Los Robles | 1,000 | August 1953 |

4. Average flow at the selected dam site for the 15 year period was 10.47 m³/sec, which corresponds to an average run-off of 27 inches over the catchment area of 479 sq.km. Average rainfall over the same area was 60 inches annually. Evaporation data was obtained from the Los Robles station which is practically in the center of the reservoir area. An

evaporation loss of 800 mm per year, corresponding to a reservoir volume of 35 million m^3 annually, was predicted and taken into account in the power study.

Sedimentation

5. The catchment area is covered by medium tropical growth; surrounding country is hilly and shows no evidence of erosion. Sedimentation measurements were started at the El Dorado gauging station in May 1956 which, when translated into an estimate of deposition for the reservoir, resulted in an estimate of 100,000 m^3 annually. The effect of sediment deposits in the reservoir would be insignificant, even after 100 years.

Geology

6. Geological and geomechanical studies for the project were done by Simecsol, a French consultant. Rock at the selected dam site was found to consist of hard and unaltered andesite on both flanks and also in the river bed. The reservoir area is covered by a clayey strata and is practically impermeable. Borings and tests indicate that the headrace canal will site almost entirely on clayey formations, presenting no construction difficulties and requiring no lining. Borings show that the tunnel will cross rocky formations of breccia and andesites. Lining will be required to ensure water tightness and low friction loss. Test excavations indicate that powerhouse foundations will bed on sound andesite with adequate bearing capacity for equipment.

Spillway Design Flood

7. Physical investigations along the river channel and information gathered from local inhabitants indicated that a flood of 1,000 to 1,200 m^3/s may have occurred at the site. Maximum flood was calculated by Creager's formula - which relates flood to drainage area - and worked out to be 4,700 m^3/s . Calculations indicated that peak flow would be reduced to 1,400 m^3/s by routing the flood through the reservoir and allowing a 2.5 m. increase of level. A reinforced concrete morning-glory spillway with a shaft discharging in the diversion tunnel (capacity 800 m^3/s) and an emergency non-controlled spillway on the right bank (capacity 600 m^3/s) are designed for this estimated peak flow.

Dam

8. The dam will be rockfill with central impervious core and curtain grouted cut-off wall. A lateral saddle on the left flank will be closed by a minor embankment.

9. The magnitude of civil work involved in the total project may be judged from the following approximate figures:

| | |
|----------------------------|------------------------|
| Open-cut excavation, earth | 600,000 m ³ |
| Open-cut excavation, rock | 375,000 m ³ |
| Tunnel excavation, rock | 60,000 m ³ |
| Dam, impervious core | 220,000 m ³ |
| Dam, rockfill | 425,000 m ³ |
| Mass concrete | 45,000 m ³ |
| Reinforced concrete | 5,000 m ³ |

Diversion Requirements

10. The upstream diversion dam will be incorporated into the final structure. During construction the river will be passed through a 290 meter long diversion tunnel built on the right flank for 400 m³/s discharge.

Surge Tank and Penstock

11. A vertical shaft, concrete and gunite lined surge tank will be located at the tunnel outlet. It is dimensioned to be able to handle sudden full load rejection. The single penstock will be controlled by a butterfly valve, have a total length of 676 meters and be divided into three sections having decreasing diameters of 2.75, 2.60 and 2.45 meters. It will be fabricated of electrically welded steel.

Power House

12. The powerhouse will consist of a circular concrete lined pit, about 20 meters in diameter and 25 meters deep, in which the turbines and generators will be installed. Two Francis turbines designed for 35,000 horsepower at 265 meter head and 11 m³/s discharge, will drive two alternators rated 31.5 MVA, 13.8 KV, 60 cycle.

Transmission and Substation

13. Power will be transmitted to Managua via a 138 KV single circuit, steel tower transmission line. The line will run in a southerly direction from the powerhouse, by Sebaco, Dario, Las Maderas and Tipitapa, where it will turn west along the shore of Lake Managua to Managua. A 10 MVA substation at Sebaco will feed Sebaco and Matagalpa via secondary voltage transmission. The voltage level for the spur line has not been finalized but will probably be 69 KV. Empresa's existing substation at the thermal station in Managua will be extended to accommodate two 30 MVA 138/69/13.8 KV transformers which will connect Tuma output with the existing Pacific system.

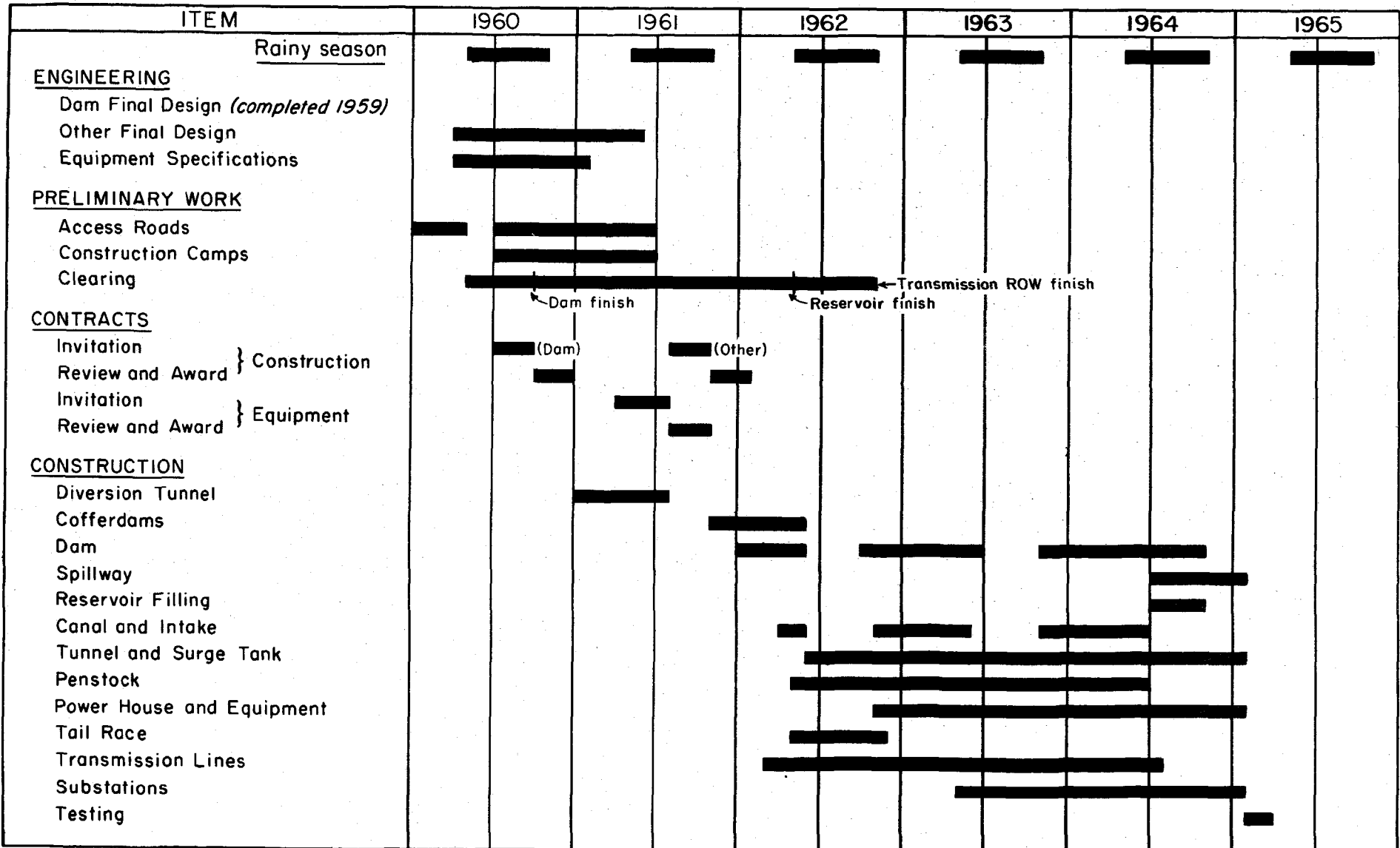
Construction Schedule

14. The schedule of construction has been estimated in accord with weather conditions prevailing in the area. The rainy season usually starts in May and continues until the end of October, heaviest rainfall occurring between June and September. Construction work is scheduled to start at the beginning of the 1960/61 dry season and to complete by the end of 1964. First unit operation is scheduled for April 1965. A bar graph showing the various construction components is shown in Annex 5.

ESTIMATED COST OF THE PROJECT

| | <u>Foreign Exchange (\$)</u> | <u>Local Currency (\$)</u> | <u>Total (\$)</u> |
|-----------------------------------------------|----------------------------------|--------------------------------|-----------------------|
| A. <u>Civil Works</u> | | | |
| Land | - | 471,300 | 471,300 |
| Dam | 1,990,600 | 1,166,200 | 3,156,800 |
| Intake and conduits | 1,234,000 | 700,900 | 1,934,900 |
| Penstock | 101,300 | 59,500 | 160,800 |
| Powerhouse | 280,400 | 217,900 | 498,300 |
| Tailrace | 208,000 | 128,600 | 336,600 |
| Substation (sending end) | 39,100 | 35,000 | 74,100 |
| Roads and bridges | 227,100 | 530,000 | 757,100 |
| Operator's village | 120,400 | 77,400 | 197,800 |
| Temporary installations | 76,200 | 38,100 | 114,300 |
| Site clearance | - | 20,000 | 20,000 |
| Sub total | <u>4,277,100</u> | <u>3,444,900</u> | <u>7,722,000</u> |
| B. <u>Electro-mechanical Equipment</u> | | | |
| Hydraulic equipment | 566,000 | 50,700 | 616,700 |
| Generators | 796,200 | 60,900 | 857,100 |
| Transformers (sending end) | 355,000 | 35,500 | 390,500 |
| Penstock | 596,400 | 93,300 | 689,700 |
| Miscellaneous | 329,600 | 15,200 | 344,800 |
| Testing and start-up | 35,000 | 46,600 | 81,600 |
| Sub total | <u>2,678,200</u> | <u>302,200</u> | <u>2,980,400</u> |
| C. <u>Transmission</u> | | | |
| Substations (civil) | 26,300 | 16,800 | 43,100 |
| Transformers | 600,800 | 46,600 | 647,400 |
| Substation equipment | 266,500 | 8,800 | 275,300 |
| Transmission lines and towers | 1,108,400 | 293,200 | 1,401,600 |
| Miscellaneous | 53,600 | 125,000 | 178,600 |
| Rights of way | - | 178,600 | 178,600 |
| Sub total | <u>2,055,600</u> | <u>669,000</u> | <u>2,724,600</u> |
| Direct Construction Cost | 9,010,900 | 4,416,100 | 13,427,000 |
| Contingencies (18%) | 1,690,500 | 733,500 | 2,424,000 |
| Total Construction Cost | <u>10,701,400</u> | <u>5,149,600</u> | <u>15,851,000</u> |
| Engineering & Supervision | 920,600 | 471,400 | 1,392,000 |
| Sub total | <u>11,622,000</u> | <u>5,621,000</u> | <u>17,243,000</u> |
| <u>Interest During Construction</u> | | | |
| IBRD Loan | 1,843,000 | - | 1,843,000 |
| DLF Loan | - | 281,000 | 281,000 |
| Total Hydro | <u>13,465,000</u> | <u>5,902,000</u> | <u>19,367,000</u> |

NICARAGUA RIO TUMA PROJECT CONSTRUCTION SCHEDULE



COMPARISON OF HYDRO AND THERMAL ALTERNATIVEExpressed in thousands of dollars
Fiscal years ending June 30

| | <u>Total</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> | <u>1969</u> | <u>1970</u> | <u>1971</u> |
|-------------------------------------------------|--------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| I. Present worth factor (8% basis from 1960) | | 1.000 | .926 | .857 | .794 | .735 | .681 | .630 | .583 | .540 | .500 | .463 | .429 |
| II. INVESTMENTS | | | | | | | | | | | | | |
| Hydro System | | | | | | | | | | | | | |
| Expenditures year by year ^{1/} | | - | 2.25 | 3.72 | 3.94 | 4.78 | 2.35 | - | - | - | - | - | - |
| Present worth | 13.51 | - | 2.08 | 3.19 | 3.13 | 3.51 | 1.60 | - | - | - | - | - | - |
| Thermal System | | | | | | | | | | | | | |
| Expenditures year by year ^{2/} | | - | - | - | - | 1.10 | 6.20 | 2.20 | 0.5 | 1.8 | 0.7 | - | - |
| Present worth | 8.03 | - | - | - | - | 0.81 | 4.22 | 1.39 | 0.29 | 0.97 | 0.35 | - | - |
| III. OPERATING EXPENSES | | | | | | | | | | | | | |
| Hydro (-Thermal) System | | | | | | | | | | | | | |
| Expenditures year by year ^{3/} | | 1.09 | 1.16 | 1.26 | 1.36 | 1.47 | 1.56 | 0.68 | 0.56 | 0.68 | 0.77 | 0.86 | 0.96 |
| Present worth | 8.78 | 1.09 | 1.07 | 1.08 | 1.08 | 1.08 | 1.06 | 0.43 | 0.33 | 0.37 | 0.38 | 0.40 | 0.41 |
| Thermal System | | | | | | | | | | | | | |
| Expenditures year by year | | 1.09 | 1.16 | 1.26 | 1.36 | 1.47 | 1.56 | 1.81 | 1.90 | 1.99 | 2.19 | 2.27 | 2.36 |
| Present worth | 12.93 | 1.09 | 1.07 | 1.08 | 1.08 | 1.08 | 1.06 | 1.14 | 1.11 | 1.07 | 1.09 | 1.05 | 1.01 |

| | <u>Hydro</u> | <u>Thermal</u> |
|---------------------------------|--------------|----------------|
| <u>Present Value of Outlays</u> | | |
| Investment | 13.51 | 8.03 |
| Operation | 8.78 | 12.93 |
| | <u>22.29</u> | <u>20.96</u> |

^{1/} Exclusive of interest during construction.^{2/} Basis \$213 per kw for first steam power units, \$200 per kw for additional unit.^{3/} Exclusive of interest charges. Between 1960 and 1965 both schemes have to rely on existing capacity, operating expenditures are therefore the same for both systems.

THERMAL ALTERNATIVEReturn on Additional Investment

A comparison was made to determine the relative level of annual cost between the proposed hydroelectric development and a hypothetical thermoelectric station of the same capacity which is assumed to be located in Managua. Such thermal station is assumed to cost \$11.2 million including interest during construction and to have fuel cost of \$0,0072/kwh (assuming 11,500BTU/kwh) generating 171 million kwh during the year of reference 1966 when a 50 MW installation would meet the system load with a reserve capacity margin. Depreciation has been computed on a 5% sinking fund basis with 40 years for hydro and 25 years for thermal.

Construction Cost

Hydro 50 MW

Thermal 50 MW

US\$ 19.4 million

US\$ 11.2 million

Including transmission line
and interest during constructionIncluding interest
during construction

Additional investment \$8.2 million for the hydro scheme.

Annual CostsHydroThermal

in US\$ million

Operating, maintenance, ad-
ministration, overhead etc.

0.25

0.42

Depreciation

0.16

0.23

Fuel

-

1.23

0.41

1.88

Annual savings for hydro: \$1,880,000 - \$410,000 = \$1,470,000

Return on additional investment about 18%.

EMPRESA NACIONAL DE LUZ Y FUERZATARIFF SCHEDULE^{1/}Tariff No. 1 (Residential or small Commercial and Industrial)

| | | | |
|--------------------------|-----|----------|--------------|
| Minimum/month for 18 KWH | C\$ | 9.00 | = US \$ 1.28 |
| First 50 kwh | | 0.50/kwh | = 0.0714/kwh |
| Next 200 kwh | | 0.45/kwh | = 0.0643/kwh |
| Next 300 kwh | | 0.35/kwh | = 0.05/kwh |
| Excess over 550 kwh | | 0.30/kwh | = 0.0428/kwh |

Tariff No. 2 (Large Commercial and Industrial)

| | | | |
|---------------------|-----|---------------------------|----------------|
| Minimum/month | C\$ | 230 | = US \$ 32.86 |
| First 210 kwh | | 0.24/kwh/kw ^{2/} | = 0.0342kwh/kw |
| Excess over 210 kwh | | 0.14/kwh | = 0.02/kwh |

Tariff No. 3 (Wholesale)

| | | | |
|---------------------|-----|-------------|--------------|
| First 210 kwh | C\$ | 0.21/kwh/kw | = 0.03kwh/kw |
| Excess over 210 kwh | | 0.13/kwh | = 0.0175/kwh |

Government

| | | | |
|-----------|-----|----------|--------------|
| Flat Rate | C\$ | 0.40/kwh | = 0.0571/kwh |
|-----------|-----|----------|--------------|

Waterworks

| | | | |
|-----------|-----|----------|--------------|
| Flat Rate | C\$ | 0.17/kwh | = 0.0242/kwh |
|-----------|-----|----------|--------------|

Irrigation

| | | | |
|-----------|-----|----------|------------|
| Flat Rate | C\$ | 0.14/kwh | = 0.02/kwh |
|-----------|-----|----------|------------|

Street Lighting

| | | | |
|-----------|-----|----------|--------------|
| Flat Rate | C\$ | 0.24/kwh | = 0.0342/kwh |
|-----------|-----|----------|--------------|

^{1/} Effective since February 1960.

^{2/} Under Tariff No. 2 a consumer whose maximum demand as measured by a demand meter did not exceed 1 kw would be charged for 210 kwh at C\$ 0.24/kwh with the excess at C\$ 0.14/kwh. If maximum demand of the same consumer were 5 kw his charge would be C\$ 0.24 for 5 x 210, or the first 1,050 kwh with the excess over 1,050kwh at C\$ 0.14/kwh.

EMPRESA NACIONAL DE LUZ Y FUERZA

CONDENSED BALANCE SHEETS FOR FISCAL YEARS 1954-1958
(in Thousands of U.S. Dollars)

| | June 30 | | | | | 8 mos. Feb. 29 | |
|------------------------------------------------|--------------|--------------|--------------|--------------|---------------|-------------------|---------------|
| | <u>1954</u> | <u>1955</u> | <u>1956</u> | <u>1957</u> | <u>1958</u> | <u>1959</u> | <u>1960</u> |
| <u>ASSETS</u> | | | | | | | |
| Fixed Assets ^{1/} | 1,818 | 2,773 | 2,864 | 3,109 | 3,309 | 13,489 | 14,919 |
| Less: Depreciation | <u>171</u> | <u>251</u> | <u>167</u> | <u>266</u> | <u>358</u> | <u>820</u> | <u>1,210</u> |
| Net Fixed Assets | <u>1,647</u> | <u>2,522</u> | <u>2,697</u> | <u>2,843</u> | <u>2,951</u> | <u>2,669</u> | <u>13,709</u> |
| Work in Progress | <u>419</u> | <u>55</u> | <u>881</u> | <u>4,573</u> | <u>9,650</u> | <u>10,621</u> | <u>-</u> |
| Total Net Fixed Assets and Work in Progress | 2,066 | 2,577 | 3,578 | 7,416 | 12,601 | 13,290 | - |
| Current Assets | 642 | 684 | 1,069 | 1,410 | 785 | 1,129 | 1,337 |
| Deferred Charges | <u>7</u> | <u>1</u> | <u>72</u> | <u>60</u> | <u>63</u> | <u>51</u> | <u>221</u> |
| Total Assets | <u>2,715</u> | <u>3,262</u> | <u>4,719</u> | <u>8,886</u> | <u>13,449</u> | <u>14,470</u> | <u>15,267</u> |
| <u>LIABILITIES</u> | | | | | | | |
| Fixed Capital | - | 1,429 | 1,429 | 1,429 | 1,429 | 1,429 | 1,429 |
| Capital Surplus | <u>1,671</u> | <u>556</u> | <u>851</u> | <u>1,061</u> | <u>1,296</u> | <u>628</u> | <u>517</u> |
| Total Equity | <u>1,671</u> | <u>1,985</u> | <u>2,280</u> | <u>2,490</u> | <u>2,725</u> | <u>2,057</u> | <u>1,946</u> |
| Government Advances | - | 49 | 357 | 1,429 | 2,143 | 2,757 | 3,146 |
| Total Equity & Government Advances | 1,671 | 2,034 | 2,637 | 3,919 | 4,868 | 4,814 | 5,092 |
| Long Term Debt | 751 | 875 | 1,570 | 4,493 | 8,032 | 8,668 | 8,674 |
| Current and Accrued Liabili- ties | 287 | 330 | 490 | 446 | 546 | 974 | 1,476 |
| Miscellaneous | <u>6</u> | <u>23</u> | <u>22</u> | <u>28</u> | <u>3</u> | <u>14</u> | <u>25</u> |
| Total Liabilities | <u>2,715</u> | <u>3,262</u> | <u>4,719</u> | <u>8,886</u> | <u>13,449</u> | <u>14,470</u> | <u>15,267</u> |
| Debt/Equity Ratio | 31/69 | 30/70 | 37/63 | 53/47 | 62/38 | 63/37 | 63/37 |
| Return: | | | | | | | |
| On Net Fixed Assets in Op- eration | 10.0 | 10.0 | 12.7 | 9.0 | 8.7 | - | - |
| On Net Fixed Assets and Work in Progress | 7.8 | 9.8 | 9.6 | 3.5 | 2.0 | - | - |

^{1/}An amount of \$750,000 has been deducted representing the book value of land property near the Presidential Palace which cannot be disposed of in the open market.

EMPRESA NACIONAL DE LUZ Y FUERZACONDENSED INCOME STATEMENTS FOR FISCAL YEARS 1954-1958
(Thousands of U.S. Dollars)

| | <u>1954</u> | <u>1955</u> | <u>1956</u> | <u>1957</u> | <u>1958</u> | <u>1959</u> | 8 mos. Feb. <u>1960</u> |
|--------------------------------------------|--------------|--------------|--------------|--------------|--------------|---------------------------|-------------------------------|
| Sales (millions of kwh): | | | | | | | |
| Managua | 21.3 | 28.0 | 31.6 | 34.5 | 37.5 | 48.1 | 36.4 |
| Other | <u>0.3</u> | <u>0.3</u> | <u>0.4</u> | <u>0.5</u> | <u>0.6</u> | <u>12.6</u> ^{1/} | <u>12.8</u> |
| Total Sales | 21.6 | 28.3 | 32.0 | 35.0 | 38.1 | 60.7 | 49.2 |
| Average rate per kwh (U.S. cents) | 4.9 | 4.65 | 4.8 | 4.85 | 4.9 | 3.34 | 3.70 |
| Operating Revenue | 1,067 | 1,332 | 1,551 | 1,718 | 1,885 | 2,106 | 1,820 |
| Other Income | <u>20</u> | <u>28</u> | <u>25</u> | <u>23</u> | <u>30</u> | <u>7</u> | <u>19</u> |
| Total Revenue | <u>1,087</u> | <u>1,360</u> | <u>1,576</u> | <u>1,741</u> | <u>1,915</u> | <u>2,113</u> | <u>1,839</u> |
| Cost of Operations: | | | | | | | |
| Operating Expenses | 859 | 1,027 | 1,138 | 1,382 | 1,555 | 1,994 | 1,356 |
| Depreciation | <u>64</u> | <u>80</u> | <u>96</u> | <u>103</u> | <u>103</u> | <u>476</u> | <u>387</u> |
| Total | 923 | 1,107 | 1,234 | 1,485 | 1,658 | 2,470 | 1,743 |
| Net Income from Operations | 164 | 253 | 342 | 256 | 257 | (-)357 | 96 |
| Less: Interest (other than capitalized) | <u>31</u> | <u>42</u> | <u>38</u> | <u>32</u> | <u>28</u> | <u>285</u> | <u>273</u> |
| Net Profit | <u>133</u> | <u>211</u> | <u>304</u> | <u>224</u> | <u>229</u> | <u>(-)642</u> | <u>(-)177</u> |

^{1/} 9 months wholesales starting October 1958

EMPRESA NACIONAL DE LUZ Y FUERZA

Final year ending June 30

Actual and Forecast Income Statements 1959 - 1969

(thousands of US dollars)

| | 1959 | 1960 8 months | 1960 | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 |
|---------------------------------------|--------|------------------|----------|-------|------|-------|-------|-------|-------|-------|-------|-------|
| | ACTUAL | | FORECAST | | | | | | | | | |
| Sales (Millions of KWH) | 60.7 | 49.2 | 75.0 | 84.0 | 94.5 | 106.8 | 120.8 | 133.6 | 148.5 | 162.2 | 175.0 | 188.0 |
| Average Revenue (US \$ per KWH) | 3.47 | 3.70 | 3.85 | 4.19 | 4.10 | 4.02 | 3.94 | 3.93 | 3.88 | 3.87 | 3.92 | 3.94 |
| OPERATING REVENUES | 2106 | 1820 | 2887 | 3520 | 3875 | 4293 | 4760 | 5250 | 5762 | 6269 | 6860 | 7407 |
| Operating and Administration Expenses | 1994 | 1356 | 1941 | 2054 | 2179 | 2332 | 2545 | 2762 | 1521 | 1649 | 1838 | 2047 |
| Depreciation | 476 | 387 | 580 | 580 | 580 | 580 | 580 | 580 | 1100 | 1100 | 1100 | 1100 |
| TOTAL OPERATING COST | 2470 | 1743 | 2521 | 2634 | 2759 | 2912 | 3125 | 3342 | 2621 | 2749 | 2938 | 3147 |
| Other Income (net) | 7 | 19 | | | | | | | | | | |
| NET INCOME BEFORE INTEREST | (357) | 96 | 366 | 886 | 116 | 1381 | 1635 | 1908 | 3141 | 3520 | 3922 | 4260 |
| Interest Payable | 363 | | 514 | 582 | 675 | 791 | 952 | 1086 | 1112 | 1058 | 1000 | 941 |
| Interest charged to Construction | 78 | | 67 | 150 | 279 | 431 | 620 | 780 | - | - | - | - |
| Interest charged to Operation | 285 | 273 | 447 | 432 | 396 | 360 | 332 | 306 | 1112 | 1058 | 1000 | 941 |
| NET PROFIT (DEFICIT) | (642) | (177) | (81) | 454 | 720 | 1021 | 1303 | 1602 | 2029 | 2462 | 2922 | 3319 |
| Cumulative Profit (Deficit) | - | - | (723) | (269) | 451 | 1472 | 2775 | 4377 | 6406 | 8868 | 11790 | 15109 |

EMPRESA NACIONAL DE LUZ Y FUERZA
Forecast Sources and Applications of Funds 1960-1969
(thousands of U.S. dollars)

Fiscal year ending June 30

| | 1960 | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 |
|-----------------------------------|--------|------|-------|------|------|------|------|------|------|------|
| SOURCES OF FUNDS | | | | | | | | | | |
| Internal Cash Generation | | | | | | | | | | |
| Net Income before Interest | 366 | 886 | 1116 | 1381 | 1635 | 1908 | 3141 | 3520 | 3922 | 4260 |
| Depreciation | 580 | 580 | 580 | 580 | 580 | 580 | 1100 | 1100 | 1100 | 1100 |
| Total | 946 | 1466 | 1696 | 1961 | 2215 | 2488 | 4241 | 4620 | 5022 | 5360 |
| Borrowings | | | | | | | | | | |
| National Bank Loan 1) | - | - | - | - | - | - | - | - | - | - |
| Export-Import Bank Loan (II) | 475 | - | - | - | - | - | - | - | - | - |
| Existing IERD Loan (154 NI) | 656 | - | - | - | - | - | - | - | - | - |
| Proposed IERD Loan | - | 1557 | 2269 | 2924 | 3610 | 2140 | - | - | - | - |
| Proposed DLF Loan | - | 552 | 913 | 483 | 483 | 69 | - | - | - | - |
| Total | 1131 | 2109 | 3182 | 3407 | 4093 | 2209 | - | - | - | - |
| Equity Contributions | | | | | | | | | | |
| | 735 | 658 | 497 | 277 | 277 | 91 | - | - | - | - |
| Total Sources of Funds | 2812 | 4233 | 5375 | 5645 | 6585 | 4788 | 4241 | 4620 | 5022 | 5360 |
| APPLICATION OF FUNDS | | | | | | | | | | |
| Proposed IERD Project F/e 2) | - | 1692 | 2505 | 3295 | 4153 | 2834 | - | - | - | - |
| L/c 2) | - | 1075 | 1800 | 1178 | 1480 | 769 | - | - | - | - |
| | | 2767 | 4305 | 4473 | 5633 | 3603 | - | - | - | - |
| Generation Expansion | 726 3) | - | - | - | - | - | - | 1400 | 1400 | 1400 |
| Distribution Expansion | 400 | 200 | 80 | 80 | 80 | 80 | 200 | 200 | 200 | 200 |
| Total | 1126 | 2967 | 4385 | 4553 | 5713 | 3683 | 200 | 1600 | 1600 | 1600 |
| Interest | | | | | | | | | | |
| National Bank Loan | 26 | 18 | 9 | - | - | - | - | - | - | - |
| Export-Import Bank Loans (I & II) | 28 | 32 | 25 | 20 | 18 | 15 | 12 | 9 | 7 | 4 |
| IERD Loans (82, 121, 154 NI) | 393 | 382 | 362 | 340 | 314 | 291 | 267 | 242 | 215 | 188 |
| Proposed IERD Loan 2) | - | - | - | - | - | - | 745 | 725 | 702 | 679 |
| Proposed DLF Loan 2) | - | - | - | - | - | - | 88 | 82 | 76 | 70 |
| Total | 447 | 432 | 396 | 360 | 332 | 306 | 1112 | 1058 | 1000 | 941 |
| Amortization | | | | | | | | | | |
| National Bank Loan | 149 | 149 | 150 | - | - | - | - | - | - | - |
| Export-Import Bank Loans (I & II) | 60 | 84 | 108 | 48 | 48 | 48 | 48 | 48 | 48 | 48 |
| IERD Loans (82, 121, 154 NI) | 445 | 467 | 490 | 512 | 507 | 499 | 523 | 548 | 575 | 602 |
| Proposed IERD Loan | - | - | - | - | - | - | 335 | 355 | 378 | 401 |
| Proposed DLF Loan | - | - | - | - | - | - | 167 | 167 | 167 | 167 |
| Total | 554 | 700 | 748 | 560 | 555 | 547 | 1073 | 1118 | 1168 | 1218 |
| Total Debt Service | 1001 | 1132 | 1144 | 920 | 887 | 853 | 2185 | 2176 | 2168 | 2159 |
| Total Application of Funds | 2127 | 4099 | 5529 | 5473 | 6600 | 4536 | 2385 | 3776 | 3768 | 3759 |
| Net Cash Accrual | | | | | | | | | | |
| Cash Balance Beginning of Year | 685 | 134 | (154) | 172 | (15) | 252 | 1856 | 844 | 1254 | 1601 |
| Cash Balance End of Year | 685 | 819 | 665 | 837 | 822 | 1074 | 2930 | 3774 | 5028 | 6629 |
| Debt service coverage | - | 1.30 | 1.48 | 2.13 | 2.50 | 2.92 | 1.94 | 2.12 | 2.32 | 2.48 |

1) Fully disbursed in 1959

2) Interest during construction shown capitalized

3) Loan 154 NI

EMPRESA NACIONAL DE LUZ Y FUERZA

Actual and Forecast Balance Sheets 1959-1969

(millions of US dollars)

| June 30 | 1959 | 1960 | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 |
|-------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| | ACTUAL | FORECAST | | | | | | | | | |
| ASSETS | | | | | | | | | | | |
| Fixed Assets | 14.1 | 15.2 | 18.0 | 22.4 | 26.8 | 32.4 | 36.1 | 36.4 | 38.0 | 39.6 | 41.2 |
| Less Depreciation | 0.8 | 1.4 | 2.0 | 2.6 | 3.1 | 3.7 | 4.3 | 5.4 | 6.5 | 7.6 | 8.7 |
| Net Fixed Assets | 13.3 | 13.8 | 16.0 | 19.8 | 23.7 | 28.7 | 31.8 | 31.0 | 31.5 | 32.0 | 32.5 |
| Deferred Assets ^{1/} | - | - | 0.2 | 0.3 | 0.4 | 0.5 | 0.5 | 0.3 | 0.2 | 0.1 | - |
| Current Assets & Others (net) | 0.2 | 0.9 | 1.0 | 0.8 | 1.0 | 0.9 | 1.2 | 3.0 | 3.9 | 5.1 | 6.7 |
| TOTAL ASSETS | 13.5 | 14.7 | 17.2 | 20.9 | 25.1 | 30.1 | 33.5 | 34.3 | 35.6 | 37.2 | 39.2 |
| LIABILITIES | | | | | | | | | | | |
| Capital and Surplus | 2.1 | 2.0 | 2.4 | 3.2 | 4.2 | 5.5 | 7.1 | 9.0 | 11.4 | 14.2 | 17.5 |
| Government Advances | 2.7 | 3.5 | 4.2 | 4.7 | 5.0 | 5.2 | 5.3 | 5.3 | 5.3 | 5.3 | 5.3 |
| Total Equity | 4.8 | 5.5 | 6.6 | 7.9 | 9.2 | 10.7 | 12.4 | 14.3 | 16.7 | 19.5 | 22.8 |
| Long Term Debt | | | | | | | | | | | |
| National Bank Loan | 0.5 | 0.4 | 0.2 | - | - | - | - | - | - | - | - |
| Ex-Im Bank Loan (I & II) | 0.2 | 0.6 | 0.5 | 0.4 | 0.4 | 0.3 | 0.3 | 0.2 | 0.2 | 0.2 | 0.1 |
| IBRD Loans (82, 121, 154 NI) | 8.0 | 8.2 | 7.8 | 7.3 | 6.8 | 6.3 | 5.8 | 5.3 | 4.7 | 4.1 | 3.5 |
| Proposed IBRD Loans | - | - | 1.6 | 3.9 | 6.8 | 10.4 | 12.5 | 12.2 | 11.8 | 11.4 | 11.0 |
| Proposed DLF Loan | - | - | .5 | 1.4 | 1.9 | 2.4 | 2.5 | 2.3 | 2.2 | 2.0 | 1.8 |
| Total Long Term Debt | 8.7 | 9.2 | 10.6 | 13.0 | 15.9 | 19.4 | 21.1 | 20.0 | 18.9 | 17.7 | 16.4 |
| TOTAL LIABILITIES | 13.5 | 14.7 | 17.2 | 20.9 | 25.1 | 30.1 | 33.5 | 34.3 | 35.6 | 37.2 | 39.2 |
| Debt/Equity Ratio | 64/36 | 63/37 | 62/38 | 62/38 | 63/37 | 64/36 | 63/37 | 58/42 | 53/47 | 48/52 | 42/58 |
| Return on Net Fixed Assets: | | | | | | | | | | | |
| a) including work in progress | - | 2.6 | (5.5) | 5.6 | 5.8 | 5.7 | 6.0 | 10.1 | (11.2) | 12.3 | 13.1 |
| b) excluding work in progress | - | 2.6 | (6.7) | 8.8 | 11.3 | 14.1 | 13.7 | 10.1 | (11.7) | 13.4 | 15.1 |

^{1/} Expenditures for management consultants.

NICARAGUA
PROPOSED RIO TUMA HYDRO DEVELOPMENT
AND TRANSMISSION LINES

Transmission Lines
 — Existing 69 KV
 - - - Existing 13.2 KV
 - - - Proposed 138 KV

Chinandega Communities now served by transmission lines
Matagalpa Communities to be served by proposed lines

