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INTERNATIONAL DEVELOPMENT ASSOCIATION

THERMAL POWER AND SEA WATER DISTILLATION PROJECT MALTA

July 29, 1963

Department of Technical Operations

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SUMMARY

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ii. MEB has been established to take over the assets, liabilities and responsibilities of the Electricity Branch of the Government Water and Electricity Department. The borrower would be the State of Malta, which would in turn relend to MEB.

iii. The Malta "B" station would have an initial installed generating capacity of 25 MW and a water production capacity of one million imperial gallons per day. It is being designed for an ultimate capacity of 100 MW and a water production of six million imperial gallons per day, and many features, such as the cooling water system, would be suitable for the next stage of development. The station would be operated by MEB as an integral unit. Its electrical output would be fed into the MEB distribution system and its output of distilled water would be sold in bulk at cost to the Government Water Department.

iv. The project is technically sound, the estimated cost is reasonable, construction schedules are realistic, and arrangements for construction are satisfactory.

v. The Ordinance which has established MEB and which will govern its operation is satisfactory.

vi. The organization planned for MEB should be satisfactory. As an interim measure the existing staff of the Electricity Branch of the Electricity and Water Department is being detailed for service with MEB. This staff will have to be strengthened, particularly at top levels, if MEB is to operate efficiently. The Government has agreed to recruit additional staff to strengthen its management.

vii. The financial position of MEB is expected to remain sound through 1965/66 without the need for any additional increase in tariffs. An overall tariff increase of about 5% will probably be required in 1966/67. The return on net fixed assets in operation is expected to average about 8% for the period April 1, 1963 to March 31, 1970. This is satisfactory. MEB should be able to cover about 34% of its capital requirements for expansion during this period from internal resources.

viii. The project is justified by the growing demand for electric power and increased needs for water which can no longer be met from natural sources. There is no alternative method of meeting these demands which would compare favorably on an economic basis.

ix. The project is considered suitable for a Bank loan of US$7.5 million equivalent, for a period of 20 years, including a grace period of three years on amortization payments.

MALTA

THERMAL POWER AND SEA WATER DISTILLATION PROJECT

I. INTRODUCTION

1. This report covers the appraisal of a project of the Malta Electricity Board (MEB) consisting of the first stage of the Malta "B" thermal power and sea water distillation station, the provision of water mains from the station to Luqa reservoir, and the provision of workshop, office and stores buildings.

2. The station would have an installed generating capacity of 25 MW and a water production capacity of one million gallons 1/ per day. It would be operated as an integral unit and the output of distilled water would be sold in bulk at cost by MEB to the Government Water Department.

3. The estimated cost of the project, including interest during construction, is £3.62 million (US$10.12 million). The Bank has been asked to make a loan of £2.68 million (US$7.5 million) to cover the estimated foreign exchange cost.

4. MEB has been established to take over the assets, liabilities and responsibilities of the Electricity Branch of the Government Water and Electricity Department. The borrower would be the State of Malta, which would in turn relend to MEB.

5. This report is based on information submitted to the Bank by the Government of Malta, and on the findings of a Bank mission which visited Malta in January and February 1962. It has subsequently been updated by more recent information submitted by the Government. The consideration of the loan was held up pending passage of necessary legislation.

II. ELECTRICITY AND WATER SUPPLIES IN MALTA

6. The Maltese Archipelago, a British colony in the Mediterranean, has an area of some 120 square miles, and a population of about 330,000. The first public electricity supply system in Malta commenced operations in 1894. The public water supply system started operations much earlier. Both electricity supply and water supply were the responsibility of the Government Public Works Department until 1930 when a new department, the Water and Electricity Department, was established to take over these functions.

1/ Imperial gallons used throughout this report.
One imperial gallon = 1.2 U.S. gallons.

7. The Government decided some years ago that existing arrangements for electricity and water supply were unsatisfactory and in 1960 appointed a committee to examine and report on the situation. In 1961 the committee recommended the establishment of an autonomous statutory authority to take over responsibility for electricity supply and the setting up of a separate government department to be responsible for water supply.

8. The committee's recommendations were accepted by the Government and an Ordinance establishing the Malta Electricity Board has recently been approved by the Legislative Council. This Ordinance is discussed in Chapter III below.

Electricity Supply

9. MEB is the only authority supplying electricity to the public. The Royal Navy operates a system which supplies the Naval Dockyard and Naval, Military and Air Force establishments throughout Malta. There are also a few small private diesel generating sets in operation which were installed immediately after the war when public supplies were restricted.

10. The Navy power station, which is situated in the Dockyard, has an installed capacity of about 20 MW. The generating plant consists of two 6-MW steam units which were installed in 1955 and a number of diesel units, of various capacities, which are 20 to 25 years old and are due for retirement in 1965. The two systems are interconnected by a cable rated at 3 MW, but additional cables are being installed which will more than double the present capacity.

11. MEB's facilities consist of a 25-MW steam power station and a distribution system which supplies Malta and the two small and sparsely populated islands of Comino and Gozo.

12. The power station, which is located underground at Marsa in Malta, has five 5-MW units, three of which were commissioned in 1953 and the other two in 1960. The station was constructed underground for defense reasons.

13. Prior to 1953 when the Marsa power station, which operates at 11 kv 3 phase 50 cycles, was commissioned the supply frequency was 100 cycles per second. To enable supplies to be given over the existing distribution system frequency changers were installed but it soon became apparent the system would be inadequate to meet increasing loads and the installation of a completely new 11-kv 3-phase 50-cycle distribution system was commenced in 1954 and completed in 1959. The new system supplies the islands of Comino and Gozo by submarine cables. Previously each island had its own diesel generating plant. Supplies to consumers from the new 50-cycle system are given at either 240 volts single phase or 415 volts 3 phase instead of at 200 volts single phase from the original 100-cycle system.

Water Supply

14. The Government Water Department supplies practically all of the water consumed in Malta. There are a few industrial establishments and a number of farms with their own wells and pumping equipment but the amount of water they produce is relatively small.

15. All the water obtained in Malta is pumped from underground sources. Rain water percolates through the ground and forms two water tables known as the Upper Water Table and the Lower Main Sea Level Water Table. The Upper Water Table consists of rainwater which has percolated through rock formations and which rests on an impermeable layer of clay. The Lower Water Table consists of rainwater which during its descent through rock formations and fissures finds no impermeable layer and floats at sea level on saline water from the sea which saturates the rock at this level. About 95% of the island's water supply is pumped from the Lower Water Table.

16. The Department's Consultants consider the maximum amount of water which can be obtained economically from natural sources is about 4,300 million gallons per annum. Additional extraction from the Lower Water Table would increase salinity beyond the acceptable limits. The Consultants state a relatively small amount of additional water, at the most 200 million gallons per annum, could be obtained from the Upper Water Table by sinking more wells but the cost of production would be prohibitive, about 144 pence (US$1.68) per 1,000 gallons.

17. As present consumption is about 3,400 million gallons per annum, it will be necessary to find other sources of supply in the near future.

III. THE MALTA ELECTRICITY BOARD (MEB)

18. The Ordinance to establish MEB in its original draft form, although generally acceptable, did not give the Board sufficient freedom to run its own affairs in accordance with sound business and utility practice. It was subsequently amended in accordance with the Bank's suggestions and it has now been approved by the Legislative Council in a form satisfactory to the Bank.

Organization and Management

19. The Ordinance provides for a Board consisting of not less than five and not more than seven members to be appointed by the Minister of Power, one of whom shall be designated by the Minister as Chairman, and of the person holding the office of General Manager as an ex-officio member. The members will be appointed from persons appearing to the Minister to be qualified by reason of having had experience of, and showing capacity in, matters relating to public utilities, electricity supply, industry, trade, finance, science or administration. Members, other than the General Manager, will be appointed for a period of three years and

will be eligible for reappointment, except that in the case of the first members, two will be appointed for a period of one year, one or two members, as the Minister shall determine, for a period of two years and the remaining members for a period of three years.

20. The Ordinance provides for the Board, with the approval of the Prime Minister, to appoint a General Manager, at such remuneration and upon such terms as it thinks fit, who shall, subject to the direction of the Board on matters of policy, be charged with the direction of the business of the Board, its administration and organization, the administrative control of its employees, and the exercise of such powers as may from time to time be delegated to him by the Board.

21. Provision is made in the Ordinance for the Board to appoint and employ, at such remuneration and upon such terms as it thinks fit, a Chief Engineer, a Chief Finance Officer, a Secretary and such other staff as may be necessary for the due and efficient discharge of its functions. It also provides that the Board may, from time to time, delegate to the General Manager all or any of these powers in respect of any of its staff other than the Chief Engineer, the Chief Finance Officer and the Secretary.

22. The Ordinance also provides for the existing staff of the Electricity Branch of the Water and Electricity Department to be detailed for service with MEB as an interim measure. The Government realizes this staff will have to be strengthened, particularly at top levels, if MEB is to operate effectively and has agreed to recruit an experienced General Manager and a Chief Finance Officer.

IV. THE MARKET FOR POWER AND WATER

Power Sales

23. Sales of electricity by the Water and Electricity Department during the past five years have increased at an average rate of 15.6% per annum, the average rate of increase for the last two years being 11.4% per annum. The total number of consumers supplied has risen from 73,000 in 1957/58 1/ to 89,000 in 1961/62, an increase of 22%.

24. Prior to the introduction of a new rate structure in October 1960, sales were only recorded under three main heads, i.e. lighting, power and street lighting. The new structure, which was designed to reduce charges generally and to stimulate sales, particularly to domestic and industrial consumers, has four main categories of consumers. A summary of sales broken down into these categories for 1961/62, the first full year of operation with the new rate structure, is as follows:

1/ The fiscal year is April 1 - March 31.

Type of Use	Sales During 1961/62 (millions of kwh)	PERCENTAGE OF Total Sales
Domestic	19.0	36.6
Commercial	14.7	28.3
Industrial	13.6	26.2
Street Lighting	4.6	8.9
Total	51.9	100.0

Forecast of Power Sales

25. The Water and Electricity Department's forecast of sales for the years 1962/63 - 1969/70 is reasonable and acceptable, if anything, it is on the low side. A table showing the estimated sales broken down into categories is attached as Annex 1. A new category, Sales to Bailey's Dockyard, has been added, making a total of five main categories. This Dockyard, which prior to August 1962 was supplied by the Naval Dockyard Power Station, presently consumes about 12 million kwh per annum. Consumption is expected to progressively increase to 20 million kwh in 1968/69.

26. In Annex 1 the percentage increases per annum, including and excluding sales to Bailey's Dockyard are shown. The average rate of increase per annum of total sales, during the period 1962/63 - 1969/70, if sales to the Dockyard are included, is 12.6%. If sales to the Dockyard are excluded, the rate of increase is 10.2%.

27. The high rate of increase in total sales over the past five years has been influenced by the industrial expansion which is taking place in Malta and by the introduction of the new rate structure. The estimated rate of increase in industrial sales during the period 1962/63 - 1964/65 is nearly 17% per annum. After 1964/65 there are few known commitments for large industrial supplies and the Department estimates the rate of increase will drop to about 6% annually. This rate of increase is low and may well be exceeded if the Government's plans for continued industrialization materialize. The department considers the high rate of increase in domestic and commercial sales since the introduction of the new rate structure is unlikely to continue. It expects the percentage increase per annum to gradually drop from 14.7% for domestic sales and 12.2% for commercial sales in 1962/63 to 5.2% and 9.0% respectively in 1969/70.

Growth in Power System Demand

28. The maximum demand on the system has increased from 11.9 MW in 1957/58 to 20.0 MW in 1961/62 and is expected to reach 45.4 MW in 1969/70. The actual increase per annum has averaged 14.0% and the average increase per annum forecast to 1969/70 is 10.8%.

29. A table showing the actual and estimated kwh generated and system maximum demand, based on the actual and estimated sales for the years 1960/61 through 1969/70 is attached as Annex 2. A chart is attached as Annex 3 which shows the curve of system maximum demand in relation to installed and firm generating capacity. By reference to the chart it will be seen that existing firm generating capacity is insufficient to meet present demands. New generating plant is scheduled to be in operation by June 1965 but system demand is expected to exceed installed capacity long before this date. To enable system demands to be met before the new plant is operating, arrangements were made in November 1962 for the Naval Dockyard power station to feed up to 4 MW into the system.

New Generating Plant Requirements

30. The new thermal power and water distillation station, Malta "B", which is part of the project proposed for Bank financing, will have two 12.5-MW sets. The first set is scheduled for completion in June 1965 and the second set in August 1965. The period between January 1963 and the commissioning of the first set in June 1965 will be critical if system demand increases as expected, as adequate standby plant will not be available and any plant breakdown will result in load shedding. After the second 12.5-MW set is commissioned in August 1965 sufficient firm capacity should be available to meet demand until mid 1967 when MEB plans to have a third set with a capacity of 25 MW in operation.

Water Consumption

31. The consumption of water during the last five years has increased at the rate of approximately 100 million gallons per annum, the consumption during 1961/62 being about 3,400 million gallons. The rate of increase has been kept down by highly progressive rates designed to discourage excessive consumption, particularly by domestic consumers. The present consumption is about 26 gallons per day per person, which, compared with the normally accepted standard in Europe of 40 gallons per day, is low.

Growth in Water Consumption

32. Estimates of water consumption, prepared by the Consultants, show an average rate of increase of about 5% per annum during the next decade. This is considerably higher than the average rate of about 3% for the past five years. In view of the present low per capital consumption and the industrialization which is now taking place in Malta, the estimates are reasonable.

33. Consumption of water, based on these estimates, is expected to reach 4,300 million gallons per annum, the maximum which can be obtained from natural sources, in 1965/66, and rise to about 5,100 million gallons per annum in 1969/70.

Water Distillation Plant Requirements

34. The only practical way of meeting future demands for water in Malta is to convert sea water to fresh water. This can be carried out by

a number of processes but most of them are in the experimental or developmental stage. The only process at present in use on a commercial basis for the conversion of large quantities of sea water is the distillation process. The most advanced type of plant using this process is the multi-stage "flash" distiller.

35. The project proposed for Bank financing includes a one-million-gallon per day multi-stage "flash" distillation plant which will be installed in the Malta "B" station and operated by steam supplied from the power generating plant. The distillation plant, which is scheduled to be in operation by September 1965, will have an annual output of about 333 million gallons. It will be operated by MEB and its output sold in bulk at cost to the Water Department.

36. To meet demands for water up to 1970, MEB plans to have three additional plants of similar capacity in operation by this date.

V. THE PROJECT

37. The project proposed for Bank financing consists of the first stage of the Malta "B" thermal power and sea water distillation station with an installed generating capacity of 25 MW and a water production capacity of one million gallons per day, the provision of water mains from the station to Luqa reservoir, and the provision of office, workshop and stores buildings.

38. The station is to be constructed at Marsa, at the head of the Grand Harbor in the city of Valletta. It will be flanked by Church Wharf on the harbor side and on the other side by Jesuit's Hill, which has been partly cut away to provide the level ground on which the station would be built. A general site plan of the station is attached as Annex 5. The station would be adjacent to the existing Malta "A" thermal power station which is located underground in Jesuit's Hill.

39. Although the initial capacity of the station would be 25 MW and about one million gallons per day water production, it is being designed for an ultimate capacity of 100 MW and a water production of six million gallons per day and many features, such as the cooling water system, will have sufficient capacity for the next stage of development.

40. The generating plant would consist of two 12.5-MW pass-out turbo-alternators and two 200,000 lbs. per hour boilers. The turbines would be designed to operate with steam conditions of 600 p.s.i. and 850°F. The boilers would be operated on Bunker "C" fuel oil which would be delivered by ship to a nearby wharf.

41. Low pressure steam would be supplied from the turbines to a "flash" type distiller with a capacity of one million gallons per day.

42. During the period September 1, 1965 - August 31, 1966, the first twelve months of operation with two 12.5-MW sets and one one-million-gallon per day distiller in commission, the output of the station is estimated at 120 million kwh and 333 million gallons of distilled water. The electrical output would be fed into the existing Malta 11 kv distribution system. The output of distilled water would be pumped through twin mains to an existing reservoir at Luqa, some 4,000 yards from the plant, where it would be blended with water obtained from underground sources.

43. A more detailed description of the project is given in Annex 4.

Status of Engineering

44. The project has been planned and is being designed by the Government's Consultants, Preece, Cardew & Rider of London. The Consultants will supervise the construction of the project. Preliminary work on site has been completed and design work is well advanced. Specifications for civil works were completed some months ago and international bids have already been obtained. Specifications for the supply and erection of equipment are being prepared and international bids will be invited.

Construction Schedules

45. The project is scheduled for completion in September 1965, with the first 12.5-MW set to come into operation in June 1965, and the second set in August 1965.

46. The schedules dates for the commencement and completion of the main features of the project are as follows:

	Construction Commences	To be Completed
Civil Works	August 1963	May 1965
Boiler No. 1	April 1964	May 1965
Turbo-Alternator No. 1	Sept. 1964	June 1965
Boiler No. 2	July 1964	July 1965
Turbo-Alternator No. 2	Dec. 1964	Aug. 1965
Distiller	Oct. 1964	Sept. 1965
Electrical Works	Aug. 1964	June 1965

This schedule is reasonable.

Estimated Cost

47. The total estimated cost of the project and the estimated cost of the principal features are shown in the following table: (A more detailed breakdown of costs is given in the project description in Annex 4.)

Estimated Cost of the Project
(£ Millions)

	Foreign Exchange Costs	Local Costs	Total Costs
Civil Works	0.42	0.38	0.80
Generating Plant	1.22	0.15	1.37
Distillation Plant	0.35	0.09	0.44
Water Mains	0.06	0.03	0.09
Office, Workshop and Stores Buildings	0.08	0.07	0.15
Engineering and Site Supervision	0.10	0.06	0.16
Contingencies	0.14	0.05	0.19
Price Escalation	0.11	0.03	0.14
	2.48	0.86	3.34
Interest during Construction	0.20	0.08	0.28
	2.68	0.94	3.62
Totals expressed in Millions of US$	7.50	2.62	10.12

48. The cost estimates are realistic and should be adequate. The sums included for price escalation and contingencies should be sufficient to cover any normal increases in the cost of labor and materials and increases in costs which may arise due to constructional difficulties.

49. The estimated yearly expenditures on the project and Bank loan disbursements are as follows:

	1963/64	1964/65	1965/66	Total
£ Millions	0.86	1.57	1.19	3.62
Equivalent US$ Millions	2.41	4.38	3.33	10.12
Bank Loan Disbursements, US$ Millions	1.80	3.00	2.70	7.50

Allocation of Investment between Power and Water Distillation

50. The total estimated cost of the project, including interest during construction is £3.62 million (US$10.12 million). This includes provision for the Malta "B" station, the water mains to Luqa reservoir, and for the office, workshop and stores buildings. The estimated cost of the Malta "B" thermal power and water distillation station alone is £3.27 million (US$9.16 million).

51. A comparison between the cost of a plant to produce power only and the cost of the combined power and water distillation plant shows the cost of the combined plant to be £772,000 more. This is the cost allocated to water distillation. If interest during construction is added the total cost to be

allocated to water distillation becomes £814,000. A summary of these estimates is attached as Annex 6.

52. Of the total estimated cost of £3.27 million (US$9.16 million) for the Malta "B" station, £2.46 million (US$6.89 million), about 75%, would be allocated to power and £0.81 million (US$2.27 million), about 25%, to water distillation.

Power - Unit Construction and Generation Costs

53. The cost allocated to power, including interest during construction, is £2.46 million (US$6.89 million). The estimated cost, excluding interest during construction, is £2.22 million (US$6.22 million), which is equal to a unit cost of US$249 per kw installed. There are, however, a number of features such as the cooling water system, which will have sufficient capacity for the next stage of development. If allowance is made for part of the cost of these features the estimated cost of the first stage becomes £1.83 million (US$5.12 million) or US$205 per kw installed, which is a reasonable cost for the size of the units to be installed.

54. The estimated cost of energy generated by the Malta "B" station during the period September 1, 1965 - August 31, 1966, the first 12 months of operation with two 12.5 MW sets in commission, is 1.02 pence per kwh generated, or 11.9 US mills, which is reasonable for the size and type of plant. Details of generating costs are given in Annex 7.

Water Distillation Costs

55. During the period September 1, 1965 - August 31, 1966, the first 12 months of operation with one distiller in commission, when it is expected 333 million gallons of distilled water will be produced, the estimated cost per 1,000 gallons of distilled water is 99 pence (US$1.15). This cost includes all fixed and operating costs. Interest on the investment allocated to water distillation has been taken at 6% per annum and straight line depreciation at 4% per annum. Details of water distillation costs are given in Annex 8.

56. As far as can be ascertained, the estimated cost of US$1.15 per 1,000 gallons compares favorably with costs for plants of similar capacity operating elsewhere, which appear to range between US$1.25 and US$1.50 per 1,000 gallons. It is, however, extremely difficult to make comparisons as the methods used for the allocation of fixed and operating costs vary considerably.

57. During the period September 1, 1966 - August 31, 1967 when MEB plans to have two distillers in operation, the cost per 1,000 gallons is expected to fall to about 90 pence (US$1.05) and in 1970 with four distillers in operation, to about 81 pence (US 94 cents).

Water Delivery Costs

58. Distilled water produced by the Malta "B" station will be delivered through twin water mains to Luqa reservoir where it will be blended with water from underground sources. The estimated cost of the mains, which are part of the project, is £116,000, including interest during construction. Interest at 6% per annum on the investment and straight line depreciation at 2½% per annum will be charged to the Government Water Department by MEB. This is estimated to amount to £9,860 which in 1965/66 would be equal to about 7 pence (US 8.2 cents) per 1,000 gallons of water delivered. In 1970, with four distillers in operation, the cost would fall to about 1.75 pence (US 2.0 cents) per 1,000 gallons delivered.

Total Water Production and Delivery Costs

59. During the period September 1, 1965 - August 31, 1966, the total estimated water production cost per 1,000 gallons delivered to Luqa reservoir is:

Distillation cost	99 pence	US$1.15
Delivery cost	7 pence	US$0.08
	106 pence	US$1.23

In 1970 with four distillers in operation the total cost per 1,000 gallons delivered is expected to be:

Distillation cost	81 pence	US$0.94
Delivery cost	2 pence	US$0.02
	83 pence	US$0.96

VI. FUTURE EXPANSION PROGRAM

60. In addition to the facilities covered by the project, provision has been made in the financial forecast for the years 1962/63 through 1969/70 for the following items:

	Estimated Cost Expressed in Millions of £	Estimated Cost Expressed in Millions of US$
(a) Expansion of Malta "B" plant with three distillers, two boilers and a 25 MW generating unit	3.06	8.57
(b) Expansion of distribution facilities	0.83	2.32
	3.89	10.89

These costs do not include interest during construction.

VII. FINANCIAL ASPECTS

61. The Electricity Branch was a division of the Electricity and Water Department of the Government of Malta. It had no financial autonomy.

62. Reports of the Electricity and Water Department were prepared annually for the fiscal years which end on March 31. The financial information was not audited and was not presented in comprehensive detail. Although no balance sheet was given in the Annual Report for the Water Branch there was one for the Electricity Branch, which recorded on the asset side the depreciated value of the fixed assets at the beginning of the year, additions during the year and the depreciation charged during the year. Depreciation was computed on a declining balance basis. The resulting year-end depreciated value of fixed assets was balanced on the liability side, after certain adjustments, with an item representing government capital. The income and expense schedules in the Annual Reports did not differentiate clearly between operating items and capital items and the scheduled amounts of capital additions for the Electricity Branch were somewhat less than the additions shown on the balance sheet.

63. Electricity rates were established by the Department itself with the approval of the Minister of Public Works. Their determination was not subject to any precise set of rules. In practice, rates had been rather high, up to 1960, averaging nearly 5 pence (US 5.8 cents) per kwh sold. On the advice of a consultant, they were reduced by about 25% in 1960. In spite of this reduction, the rates produced revenues sufficient to cover all operating expenses of the Electricity Branch including depreciation and to leave a substantial operating surplus.

64. This surplus, together with depreciation allowances, (i.e., the net receipts from operations) was paid back to the Government's general revenue account, while funds for new construction were provided out of an entirely separate government capital budget.

65. Operating results of the Electricity Branch for the years 1960/61, 1961/62 and preliminary figures for 1962/63 are summarized in Annex 9. The figures are based on an attempted elimination of capital items but must be regarded as approximations. Because of the reduction in rates, revenues from sales of energy decreased from £781,000 in 1960/61 to £698,000 in 1961/62 in spite of an increase in sales from about 47 to about 52 million kwh. This has resulted in total payments to Government declining from £379,000 in 1960/61 to £296,000 in 1961/62.

66. Although the return on investment is difficult to ascertain with accuracy because of the form in which Government accounts have been kept, it is estimated at about 4.2% for the 1962/63 fiscal year.

The Malta Electricity Board

67. The summary opening balance sheet of MEB estimated as of April 1, 1963 is as follows:

	(£ Millions)
ASSETS	
Fixed assets in operation	4.98
Net current and other assets	0.31
Total Assets	5.29
LIABILITIES	
Government capital	5.29

68. The basis for establishing the valuation of the fixed assets in operation as shown above was the balance in the respective accounts on the books of the Electricity Branch as of March 31, 1962, adjusted for the estimated additions and depreciation to March 31, 1963. A summary of this calculation is presented below:

Book value of fixed assets in operations on March 31, 1962	£4,971,478
Additions during the year ending March 31, 1963	189,675
Total	5,161,153
Depreciation for the year ending March 31, 1963	181,358
Balance March 31, 1963	£4,979,795

In the future depreciation on this acceptable valuation will be computed on the straight line method.

Status of the Government Capital

69. The Government has agreed that it will treat the capital of MEB as non-repayable advances represented by permanent subordinated debentures carrying interest at 6% per annum. As these debentures will not be subject to any amortization or sinking fund provision, and will be subordinated to all other form of loans, the permanent capital of MEB will be regarded as equity.

70. At the rate of 6% per annum, payments on this permanent capital will continue to provide the Government's general revenue with substantial funds initially amounting to £317,000 annually. The Government has agreed that it will contribute additional capital of £150,000 and £375,000 during the fiscal years of 1963/64 and 1964/65 respectively. These funds will be advanced under the same terms and conditions as those applicable to the original Government capital contribution. The eventual payments to the Government will be £349,000 annually.

Capital Expenditures and Sources of Funds

71. MEB's total capital requirements for new construction in the seven years 1963/64 to 1969/70 are estimated at about £8.06 million (US$22.6 million) with nearly half of the expenditures to be incurred in the three years 1963/64 to 1965/66 for the execution of the project.

72. The following table gives a comparison between MEB's requirements of funds and its estimated internal resources. (For details see Annexes 9 and 10.)

	1963/64-1965/66	1966/67-1969/70	Total 1963/64-1969/70
		(in millions of £)	
Construction costs	3.96	4.10	8.06
Increase in working capital	0.11	(0.01)	0.10
Total requirements (A)	4.07	4.09	8.16
Net receipts from operations	1.82	4.45	6.27
Less: Debt service charges	0.95	2.55	3.50
Available for reinvestment (B)	0.87	1.90	2.77
B/A	21%	46%	34%

73. MEB would thus meet out of its own resources about 21% of its capital needs over its first three years of operation and about 46% over the four years following completion of the project. For the full seven year period, internal cash generation would cover about 34% of capital requirements.

74. Sources of funds for the capital expansion program would be approximately as follows, expressed in percentages:

	1963/64-1965/66	1966/67-1969/70	Total 1963/64-1969/70
Internal cash generation	21	46	34
Government advances	13	-	6
Foreign borrowings	66	49	58
Local borrowings	-	5	2
	100	100	100

75. During the period 1963/64 through 1965/66 new funds would consist of (a) the proposed Bank loan of £2.7 million (US$7.5 million) and (b) government advances totalling £525,000 (US$1.47 million). These advances would be in the form of subordinated debentures, which will form part of the permanent capital of MEB and on which 6% per annum will be paid.

76. A future foreign loan of £2 million (US$5.6 million) has been assumed in 1966/67 to cover a large part of the foreign currency requirements of Stages II and III of the expansion project. Local borrowings of £200,000 have also been assumed in the year 1968/69.

77. The proposed financing program is reasonable.

Rates and Estimated Financial Results

78. As already mentioned (paragraphs 35, 55-59), charges for distillation and delivery of water will be equal to actual costs. Water charges are expected to decrease gradually from 105.8 pence (US$1.23) per 1,000 gallons in 1965/66 to 82.6 pence (US 96 cents) in 1969/70.

79. It is expected that present electricity rates will be maintained through the 1965/66 fiscal year and that a general overall rate increase of approximately 5% will be in effect thereafter. Average revenue per kwh sold during the period 1963/64 through 1969/70 would be approximately 3.01 pence (US 35 mills). This rate level should satisfy the requirements of the Electricity Ordinance which provides, inter alia, that rates should be sufficient to cover operating expenses including interest and depreciation or amortization, whichever is higher, and permit accumulation of a reasonable surplus for reinvestment.

80. A forecast of earnings is presented in the income statement for the years 1963/64 through 1969/70 in Annex 9 and the projection of cash flows for the same period is attached as Annex 10. The estimates of revenues are based on the growth of sales as discussed in Chapter IV.

81. As the wording of the Ordinance clause referring to electricity rates is rather general, MEB has undertaken to establish rates at a satisfactory level to maintain an operating ratio not greater than 67%, calculated on a three-year moving average, commencing April 1, 1963.

82. For purposes of calculation, the proposed Bank loan has been assumed to carry interest at 5½% per annum and have a term of 20 years, with amortization beginning in April 1966. The foreign loan to be obtained in the fiscal year 1966/67 has also been assumed to carry an interest rate of 5½% and a term of 20 years with a grace period of three years.

83. The operating income is expected to increase from £307,000 in 1963/64 to £785,000 in 1969/70. The annual operating ratio would improve from 70.0% in 1963/64 to an average of 63.8% in the succeeding years through 1969/70.

84. The rate of return on the average net fixed assets in operation is expected to be 6.3% in 1963/64 and this percentage should improve and average about 8.7% during the next six years. During the initial year of operation the full payments of 6% on the government capital will not quite be covered.

85. Considering the Government's investment as equity rather than debt, the debt service coverage would range from a low of 1.71 in 1966/67 to a high of 2.75 with an average of approximately 2.28. The computation of this coverage was based on the current debt service plus that applicable to the debt to be incurred and related to the previous year's operating income plus depreciation.

86. Projected balance sheets of MEB as at the end of each year from 1963/64 to 1969/70 are shown in Annex 11. Net fixed assets in operation would more than double during this period. If government capital is considered as equity, the ratio would be 11/89 as of March 31, 1964, and 39/61 as of March 31, 1970.

87. MEB has also undertaken not to incur additional debt unless net receipts from operations for a recent 12-month period, factored with any rate increase in effect at the time the new debt is to be incurred, should be at least 1.6 times the maximum debt service requirements for any succeeding fiscal year on all indebtedness, excluding subordinated Government debt but including the indebtedness proposed to be incurred.

Auditing Procedures

88. Previously the operations of the Electricity and Water Department were not subject to regular audits. MEB has agreed to arrange for annual audits of its accounts and certifications of annual financial statements by qualified independent public accountants.

VIII. JUSTIFICATION OF THE PROJECT

89. The project is needed to meet growing demands for electric power and water in Malta. The construction of the Malta "B" thermal power and sea water distillation station is an economical means of increasing generating capacity and is considered by the Government's consulting engineers to be the only practical means of providing additional fresh water.

90. About 16% of MEB's total revenues during the period April 1, 1965, through March 31, 1970, would be from the sale of water. The water would be sold in bulk to the Water Department at cost, including 6% interest and adequate depreciation.

IX. CONCLUSIONS

91. The project proposed for Bank financing is technically sound, the estimated costs are reasonable, the construction schedule is realistic and arrangements for construction are satisfactory.

92. The new generating facilities are necessary to meet the reasonable estimated increase in power demand. The construction of the water distiller plant is required to meet the growing demand for water which can no longer be met from natural sources. The combination of these installations provides savings both in initial investment and in operating costs.

93. Taking into account the planned addition of top level staff to strengthen the management of MEB, its organization can reasonably be expected to be competent to carry out the construction of the project and satisfactorily operate the expanded power system and water distilling plant.

94. The funds required by MEB to finance the project in addition to the proposed Bank loan would be obtained from retained earnings supplemented by Government advances. Financial forecasts show that the financial position of MEB can be expected to remain sound. The return on net fixed assets in operation should average about 8% and MEB could be expected to finance over 30% of future capital requirements from internally generated funds.

95. In connection with the proposed loan MEB has, in particular, undertaken:

(a) To continue to retain qualified consulting engineers to be responsible for design, engineering and supervision of construction.

(b) To appoint a General Manager with qualifications and experience satisfactory to the Bank.

(c) To maintain power rates at a level sufficient to assure an operating ratio of not more than 67%, calculated on the basis of a three-year moving average.

(d) To retain independent qualified public accountants to carry out regular audits of MEB's accounts.

96. The project forms a suitable basis for a Bank loan of $7.5 million equivalent. A period of amortization of 20 years, including three years of grace, would be appropriate.

MALTA

ACTUAL AND ESTIMATED SALES - 1957/58 - 1969/70

(Millions of kwh)

Year	Lighting kwh	Lighting Percentage Increase per Annum	Lighting Percentage of Total Sales	Power kwh	Power Percentage Increase per Annum	Power Percentage of Total Sales	Street Lighting kwh	Street Lighting Percentage Increase per Annum	Street Lighting Percentage of Total Sales	Total Sales kwh	Total Sales Percentage Increase per Annum
ACTUAL											
1957/58	13.5	-	45.9	12.9	-	43.9	3.0	-	10.2	29.4	-
1958/59	15.2	12.6	48.0	13.2	2.3	41.6	3.3	10.0	10.4	31.7	7.8 1/
1959/60	17.5	15.1	41.9	20.9	58.3	50.0	3.4	3.0	8.1	41.8	31.9 1/
1960/61	-	-	-	-	-	-	3.8	11.8	8.2	46.5	11.2 2/
1961/62	-	-	-	-	-	-	4.6	21.1	8.9	51.9	11.6
Average percentage Increase per annum											15.6

Year	Domestic kwh	Domestic Percentage Increase per Annum	Domestic Percentage of Total Sales	Commercial kwh	Commercial Percentage Increase per Annum	Commercial Percentage of Total Sales	Industrial kwh	Industrial Percentage Increase per Annum	Industrial Percentage of Total Sales	Bailey's Dockyard kwh	Bailey's Dockyard Percentage Increase per Annum	Bailey's Dockyard Percentage of Total Sales	Street Lighting kwh	Street Lighting Percentage Increase per Annum	Street Lighting Percentage of Total Sales	Total Sales kwh	Total Sales Percentage Increase per Annum	Total Sales Excluding Bailey's Dockyard kwh	Total Sales Excluding Bailey's Dockyard Percentage Increase per Annum	Year
ACTUAL 1961/62	19.0	-	36.6	14.7	-	28.3	13.6	-	26.2	-	-	-	4.6	21.1	8.9	51.9	11.6	51.9	11.6	1961/62
ESTIMATED																				
1962/63	21.8	14.7	35.0	16.5	12.2	26.5	15.0	10.3	24.1	4.0	-	6.4	5.0	8.7	8.0	62.3	20.0	58.3	12.3	1962/63
1963/64	24.8	13.8	31.5	18.5	12.1	23.4	18.0	20.0	22.8	12.0	200.0	15.2	5.6	12.0	7.1	78.9	26.6	66.9	14.8	1963/64
1964/65	27.8	12.1	31.6	20.5	10.8	23.3	21.5	19.4	24.4	12.0	-	13.6	6.2	10.7	7.1	88.0	11.5	76.0	13.6	1964/65
1965/66	31.1	11.9	32.0	22.8	11.2	23.5	22.4	4.2	23.1	14.0	16.7	14.4	6.8	9.7	7.0	97.1	10.3	83.1	9.3	1965/66
1966/67	34.8	11.9	32.5	25.1	10.1	23.5	23.6	5.4	22.1	16.0	14.3	14.9	7.5	10.3	7.0	107.0	10.2	91.0	9.5	1966/67
1967/68	36.6	5.2	31.5	27.6	10.0	23.7	25.3	9.3	22.2	18.0	12.5	15.5	8.2	9.3	7.1	116.2	8.6	98.2	7.9	1967/68
1968/69	38.5	5.2	30.9	30.1	9.1	24.1	27.3	7.8	21.9	20.0	11.1	16.0	8.9	8.5	7.1	124.8	7.4	104.8	6.7	1968/69
1969/70	40.5	5.2	30.6	32.8	9.0	24.8	29.3	7.3	22.2	20.0	-	15.1	9.7	9.0	7.3	132.3	6.0	112.3	7.2	1969/70
Average percentage increase per annum 1962/63 - 1969/70		10.0			10.1			10.2			36.4			9.8			12.6		10.2	
Average percentage of Total Sales 1962/63 - 1969/70			32.9			24.1			22.3			13.9			7.2					

ANNEX 1

Financial Year - April 1 - March 31.

1/ Late billing in 1958/59 carried over to 1959/60.
2/ Mid-year change to new rate structure.

July 23, 1963

MALTA

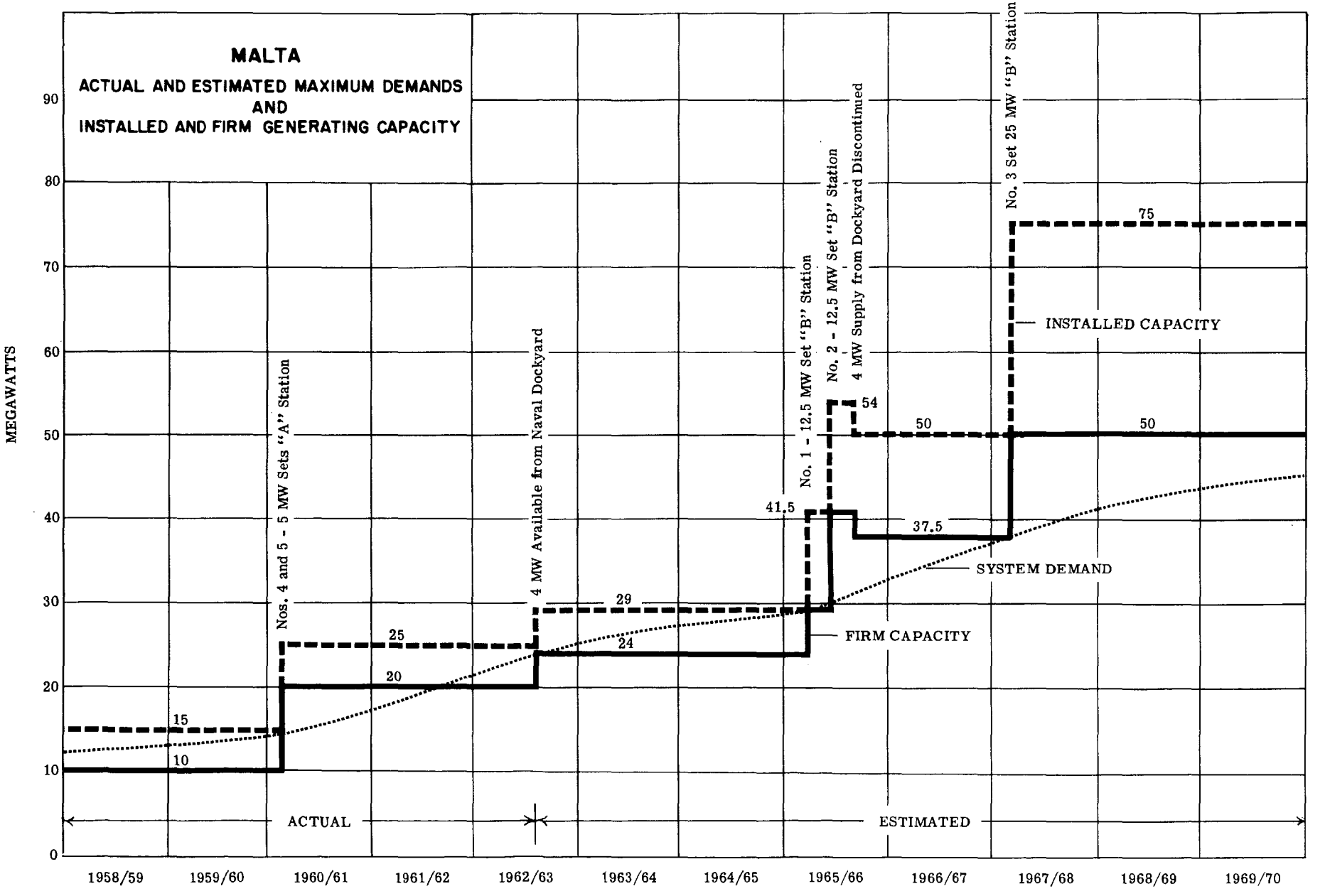
Actual and Estimated kwh Generated and Sold, System Maximum Demand, Installed and Firm Generating Capacity, Annual Load Factor and System Losses

Year	Kwh Generated (Millions)	Kwh Sold (Millions) To Consumers	Kwh Sold (Millions) To Distillers	Kwh Sold (Millions) Total	System Losses (%)	Power Station Auxiliaries 1/ (%)	System Annual Load Factor (%)	System Maximum Demand (MW)	Installed Capacity (MW)	Available From Dockyard (MW)	Firm Capacity (MW)
ACTUAL											
1960/61	65.6	46.5	-	46.5	23	9	44.3	16.9	25.0	-	20.
1961/62	74.7	51.9	-	51.9	23	9	42.6	20.0	25.0	-	20.
ESTIMATED											
1962/63	87.8	62.3	-	62.3	22	9	42.5	23.6	25.0	4.0 2/	24
1963/64	111.1	78.9	-	78.9	22	9	46.7	27.1	25.0	4.0	24
1964/65	122.2	88.0	zero	88.0	20	10	50.0	27.9	25.0	4.0	24.0
1965/66	136.0	97.1	0.8	97.9	20	10	47.0	33.0	50.0	4.0	41.5 3/
1966/67	145.3	107.0	2.8	109.8	18	8	45.5	36.4	50.0	-	37.5
1967/68	158.3	116.2	4.8	121.0	18	7	45.0	40.1	75.0	-	50.0 4/
1968/69	166.2	124.8	6.8	131.6	16	6	44.8	42.3	75.0	-	50.0
1969/70	177.8	132.3	8.0	140.3	16	6	44.6	45.4	75.0	-	50.0

1/ Kwh used by Power Station auxiliaries are high because "A" Station is underground and requires forced ventilation and permanent artificial lighting.
2/ 4 MW available during daily peak load periods from Naval Dockyard Power Station.
3/ Nos.1 and 2 - 12.5 MW sets, "B" Station to be commissioned in June 1965 and August 1965 respectively.
4/ No. 3 - 25 MW set, "B" Station to be commissioned in mid 1967.

July 23, 1963

ANNEX 2



JANUARY 1963

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Annex 3

Detailed Description of the Project

The Malta "B" thermal power and sea water distillation station would be constructed at Marsa, at the head of the Grand Harbour on level ground between Jesuit's Hill and Church Wharf. It would be adjacent to the existing Malta "A" thermal station which is situated underground in Jesuit's Hill. A site plan of the station is attached as Annex 5. The station would be designed for an ultimate capacity of 100 MW and a water production of 6 million gallons per day. Initially only 25 MW of generating plant and a one million gallon per day distiller would be installed but many features would have sufficient capacity for the next stage of development. The station, which would be operated as an integral unit, would utilize low pressure pass-out steam from turbo-alternator generating sets for the distillation of sea water.

The station would be of the semi-outdoor type with a steel framed structure covered with light weight steel cladding to house the turbo-alternator sets and control equipment. Sea water would be used for cooling purposes and this would be pumped to the station from an intake chamber at Bridge Wharf through tunnels and returned through similar tunnels to an outfall at Church Wharf. The size of the tunnels would be sufficient for the next stage of development.

The generating plant would consist of two 12.5 MW pass-out turbo-alternator sets and two 200,000 lbs. per hour boilers.

The turbines would be designed to operate with steam conditions of 600 p.s.i. 850°F, and a vacuum of 27.75 inches Hg with cooling water at 80°F, and would each be capable of passing out up to 112,000 lbs. per hour of steam at a pressure of 5 p.s.i. gauge. At full output each distiller would require about 36,500 lbs. per hour of pass-out steam; hence each turbine would be capable of supplying three distillers. To enable the turbines to be operated as conventional condensing units, if pass-out steam is not required for sea water distillation, condensers of sufficient capacity for full load operation would be provided. Each turbine will be directly coupled to a 12.5 MW, 3 phase 11 kv 0.8 pf 50-cycle alternator.

The boilers, which would be of the outdoor type, would be designed to operate on Bunker "C" fuel oil. Steam conditions at the super heater outlet would be 625 p.s.i. and 875°F. Each boiler would be a self-contained unit with an economizer, air preheater and forced and induced draft fans. The boilers would be connected to a high pressure steam main from which the turbines would be supplied. Feed heating, de-aerating and water treatment plant, together with two motor driven and one steam driven feed pumps would be installed. Fuel oil, which would be delivered by ship to a nearby wharf, would be pumped into two storage tanks, each of 4,000 tons capacity, which would be erected on Jesuit's Hill, behind the station.

The electrical output of the station would be fed into the Malta 11 kv distribution system via the main switchboard of the Malta "A" station.

The sea water distillation plant would consist of a "flash" type distiller with a capacity of 1 million gallons per day. Low pressure steam at about 5 p.s.i. gauge would be supplied from the power plant pass-out turbines and from the exhausts of turbine driven brine recirculating pumps to operate the distiller. Steam for the turbine driven pumps and steam to operate air ejectors would be supplied direct from the boiler plant.

In a "flash" distiller, sea water is progressively heated and then introduced into a chamber where a pressure just below atmospheric pressure is maintained, thus reducing the boiling point of the hot sea water, or brine. When the brine enters this chamber the reduced pressure causes part of the liquid to immediately boil - or flash - into steam. The remaining brine is passed through a series of similar chambers at successively higher vacuums where the flash process is repeated at progressively lower temperatures.

A simplified diagram showing the operation of a flash type distillation plant with three chambers or stages is attached herewith. In practice the number of stages would be much higher, usually between 20 and 40, the actual number depending on the steam/distillate ratio required.

By reference to the diagram, it will be seen progressive heating is accomplished by piping incoming sea water through heat exchanges situated in each flash chamber, starting at the low temperature end (No. 1 chamber). In each chamber the flashed vapor condenses upon coming into contact with the heat exchanger and thus gives up its heat to the incoming sea water, or brine. The brine is then passed through the feed heater which is supplied by low pressure steam from the pass-out turbines of the power plant.

The hot brine then enters No. 3 chamber where the reduction in pressure causes part of it to flash into vapor. The vapor condenses when it contacts the heat exchanger, falls onto a collecting tray, and is then piped away.

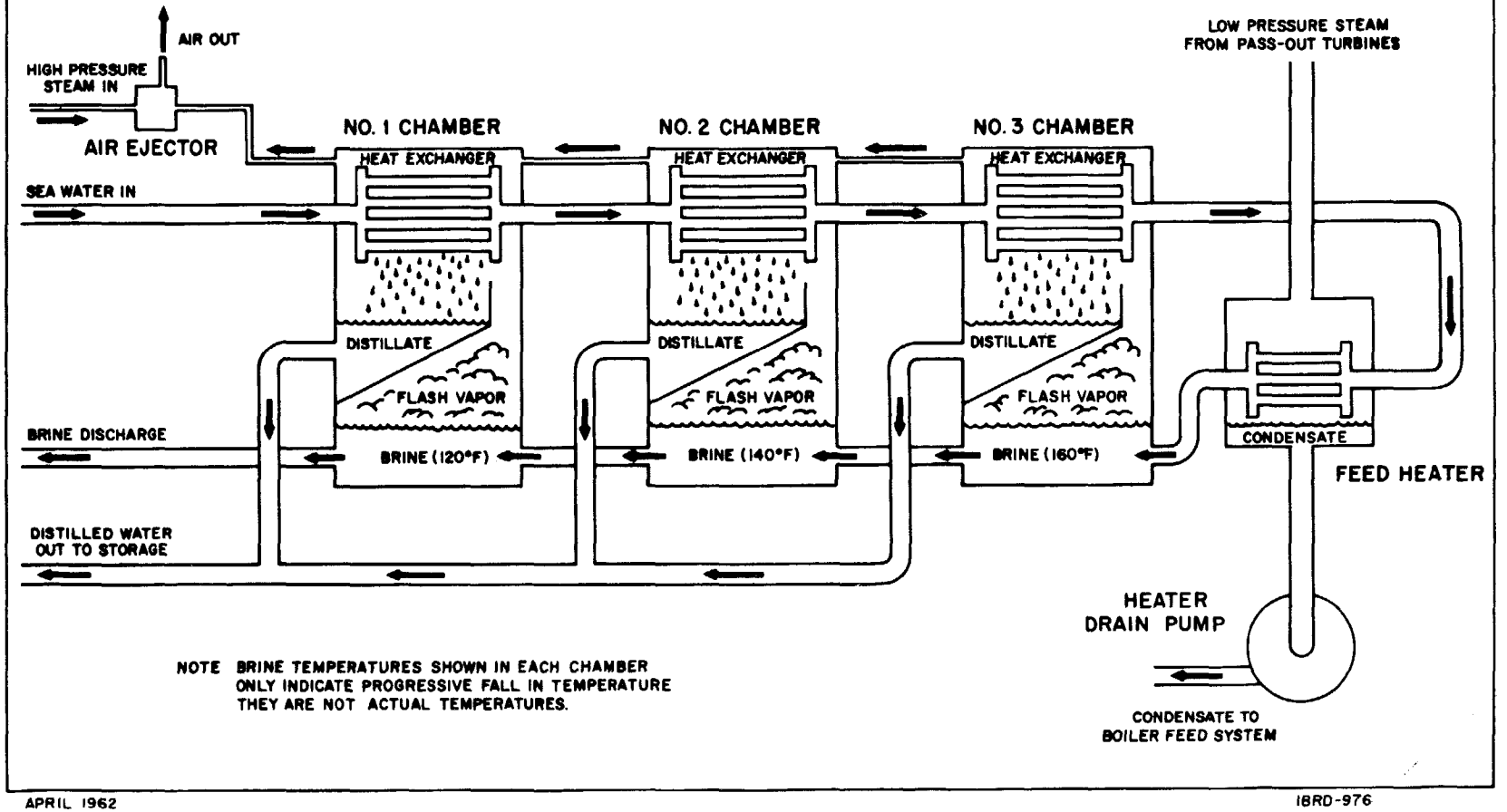
The remaining brine is then passed to chambers No. 2 and No. 1 where the process is repeated at successively higher vacuum and progressively lower temperatures.

A high vacuum is created in No. 1 chamber and progressively lower degrees of vacuum in subsequent chambers by a steam jet air ejector which is operated by steam supplied from the power plant boilers.

The estimated water production costs during the period September 1, 1965 - August 31, 1966 are detailed in Annex 9. By reference to this table it will be seen 36,500 lbs. per hour of low pressure steam from the pass-out turbines and 13,000 lbs. per hour of steam direct from the boilers to operate the recirculating pumps and air ejectors, making a total of 49,500 lbs. per hour of steam, will be required to obtain a water production of 1 million gallons per day.

MALTA

SIMPLIFIED DIAGRAM SHOWING OPERATION OF FLASH TYPE DISTILLATION PLANT



NOTE BRINE TEMPERATURES SHOWN IN EACH CHAMBER ONLY INDICATE PROGRESSIVE FALL IN TEMPERATURE THEY ARE NOT ACTUAL TEMPERATURES.

APRIL 1962

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To supply 36,500 lbs/hr. of low pressure steam to the distiller the pass-out turbines would require about 15,000 lbs/hr. more steam than for conventional condensing type sets generating the same power output. The total amount of steam to be supplied by the boiler which is chargeable to distillation is therefore:

	15,000 lbs/hr.	additional steam to the pass-out turbines
	12,000 "	to the turbine driven recirculating pump
	1,000 "	to the air ejectors
Total	28,000 lbs/hr.	

The water produced by the distillation plant would be pumped through twin mains, with sufficient capacity for the output of six distillers, to Luqa reservoir, some 4,000 yards from the plant, where it would be blended with water obtained from underground sources.

The Estimated Cost of the Project

A breakdown of the estimated cost of the project is given in the following table:

Estimated Cost of the Project

(£)

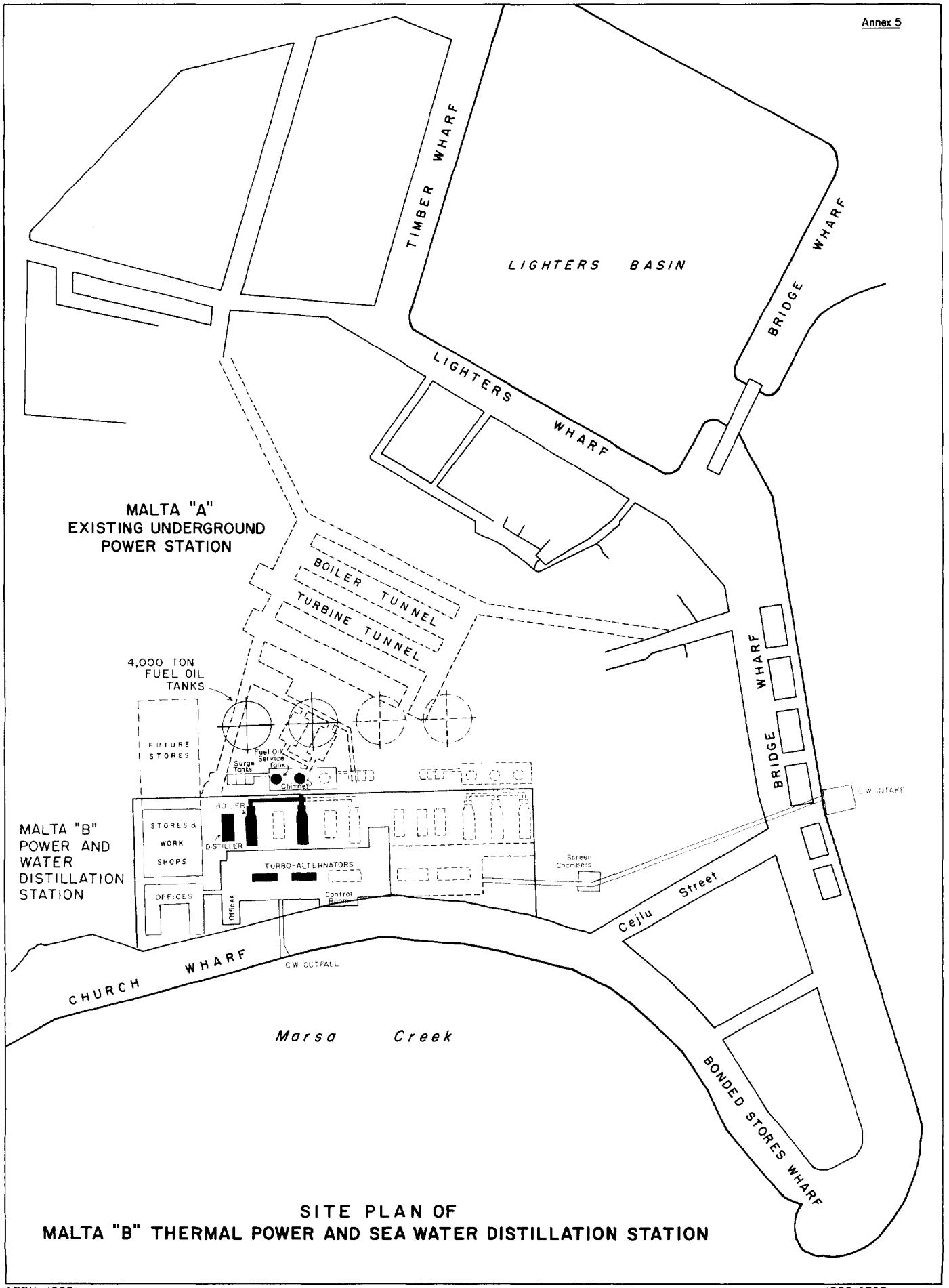
	Foreign Exchange Costs	Local Costs	Total Costs
Preliminary Works			
Acquisition of land	-	100,000	100,000
Preliminary fees and expenses	-	2,500	2,500
		102,500	102,500
Civil Works			
Foundations	44,400	40,000	84,400
Structural steelwork	143,000	14,000	157,000
Station building	78,400	63,500	141,900
Cooling water system	141,000	141,150	282,150
Extension of Church Wharf Quay	-	4,250	4,250
Miscellaneous works	10,000	7,850	17,850
Sub-Total	416,800	270,750	687,550
Mechanical and Electrical Works			
Two 12.5 MW turbo-alternators	533,000	42,000	575,000
Two 200,000 lbs. per hour boilers	304,000	40,000	344,000
Boiler and turbine room cranes	42,500	3,500	46,000
Pipework, pumps, valves, etc.	136,500	35,000	171,500
Switchgear, transformers, cables	178,500	20,000	198,500
Two 4,000 ton steel oil storage tanks	30,600	6,000	36,600
Sub-Total	1,225,100	146,500	1,371,600
Distillation Plant			
One million gallon per day distiller	345,000	95,000	440,000
Water Works			
Twin mains to Luqa reservoir	65,000	28,000	93,000

	Foreign Exchange Costs	Local Costs	Total Costs
Office, Workshop and Stores Buildings	77,000	75,000	152,000
Engineering and Site Supervision	100,500	54,250	154,750
Contingencies 1/			
Civil Works	57,400	41,300	98,700
Mechanical and Electrical Works	82,200	12,800	95,000
Price escalation	106,000	33,000	139,000
Sub-Total	245,600	87,100	332,700
Interest during construction	205,000	77,000	282,000
Total	2,680,000	936,100	3,616,100
Totals expressed in Millions of US$	7.50	2.62	10.12

1/ Contingencies calculated as follows:

Civil Works	- 10%	on foreign and local costs
Mechanical and Electrical Works	- 5%	" " " "
Price Escalation	- 4½%	" " " "

Annex 5



SITE PLAN OF
MALTA "B" THERMAL POWER AND SEA WATER DISTILLATION STATION

APRIL 1962

IBRD-978R

MALTA

Comparison of the Estimated Cost of a 25 MW Thermal Power and Water Distillation Plant with the Estimated Cost of a 25 MW Thermal Power Plant

	(1) Combined Plant	(2) Power Plant	Difference (1) - (2)
Turbines			
2 -12.5 MW pass-out sets	575,000		
2 -12.5 MW condensing sets		502,000	73,000
Boilers			
2 -200,000 lbs. per hour units	344,000		
2 -160,000 lbs. per hour units		308,500	35,500
Distiller			
1 million gallons per hour	440,000		440,000
Cranes			
60 and 10 ton	46,000		
60 ton		28,600	17,400
Pipework, Tanks, Valves, Pumps, etc.	171,500	162,200	9,300
Switchgear, Transformers, Cables, etc.	198,500	182,800	15,700
Oil Storage Tanks			
2 -4,000 ton capacity	36,600	36,600	-
Civil Works	790,050	716,450	73,600
Engineering and Site Supervision	134,000	98,300	35,700
Contingencies	170,000	131,000	39,000
Price Escalation	126,500	93,700	32,800
	3,032,150	2,260,150	772,000
Estimated additional cost of power and water distillation plant			772,000

ANNEX 7

Malta "B" Thermal Power and Water Distillation Station

Power Generating Costs, September 1, 1965 - August 31, 1966

Total Investment Allocated to Power	2,460,000
Installed Capacity	25 MW
Kwh Generated	120 million kwh
Annual Average Gross Thermal Efficiency	24.5%
Heat Value of Fuel	18,500 B.T.U. per lb.
Unit Cost of Fuel	£5 (US $14.0) per metric ton 1/ or US 34 cents per million B.T.U.
Annual Fuel Consumption	40,816 metric tons

Annual Costs

Fixed Costs		
Interest at 6% per annum on £2,460,000		£147,600
Depreciation,		
Civil Works - 2% per annum on 965,000		19,300
Generating Plant - 4% per annum on £1,495,000		59,800
		£226,700
Operating Costs		
Fuel		£204,080
Salaries, Wages, etc.		45,000
Repairs and Maintenance		35,000
		£284,080
Total Annual Costs		£510,780
Cost per kwh Generated		1.02 pence
	or	US 11.9 mills

1/ One metric ton = 2,205 lbs.

ANNEX 8

Malta "B" Thermal Power and Water Distillation Station

Distilled Water Production Costs, September 1, 1965 - August 31, 1966

Total investment allocated to water distillation	£ 814,000
Capacity of distiller	1 million gallons per day
Operating hours	8,000 per annum
Water Production	333 million gallons per annum
Fixed Costs	
Interest at 6% per annum on £ 814,000	£ 48,840
Depreciation at 4% per annum	32,560
	£ 81,400
Fixed cost per 1000 gallons of distilled water	59 pence
Operating Costs	
Steam requirements of distiller:	
Low pressure steam from pass-out turbines	36,500 lbs/hr.
Low pressure steam from turbine-driven brine recirculating pumps	12,000 "
Steam direct from boilers to operate air ejectors	1,000 "
Total	49,500 lbs/hr.
Additional steam to be supplied by the boilers for distiller operation:	15,000 lbs/hr. to pass-out turbines 1/
	12,000 " to turbine driven brine recirculating pumps
	1,000 lbs/hr. to air ejectors
Total	28,000 lbs/hr.
Boiler fuel consumption for additional steam	= 2,050 lbs/hr.
	= 73.2 lbs/hr. of steam
Water production per hour	= 41,600 gallons

1/ To supply 36,500 lbs/hr. of low pressure steam to the distiller the power plant pass-out turbines will require about 15,000 lbs/hr more steam from the boilers than conventional condensing type sets.

Fuel required to produce 1000 gallons of distilled water	49.2 lbs.
Unit cost of fuel oil	£5 per metric ton (2050 lbs.)
Cost of fuel to produce additional steam per 1000 gallons of distilled water	26.5 pence
Electric power for distiller auxiliaries	2.5 million kwh per annum
Cost per kwh generated "B" station	0.6 pence
Cost of power for distiller auxiliaries and pumping per 1000 gallons of distilled water	4.5 pence
Chemical treatment - Estimated annual cost	£7000
Cost of chemical treatment of sea water per 1000 gallons of distilled water	5 pence
Operation and maintenance - Estimated annual cost	£5500
Operation and maintenance cost per 1000 gallons of distilled water	4 pence

Total cost of water distillation per 1000 gallons

	Pence
Fixed cost	59.0
Fuel for additional steam	26.5
Electric power	4.5
Chemical treatment of sea water	5.0
Operation and maintenance	4.0
	99.0 = US $1.15 per 1000 gallons

Water Delivery Cost [1]

Cost of water mains to Luqa reservoir, including interest during construction	£116,000
Interest at 6% per annum	£6,960
Depreciation at 2½% per annum	2,900
	£9,860
Cost per 1000 gallons of distilled water delivered	7 pence = US 8.2 cents

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1/ Cost of pumping equipment and electric power to operate pumps included in distillation costs.

Total Cost of Water Production

Cost per 1000 gallons delivered to Luqa reservoir

Distillation cost	99 pence =	US$ 1.15
Delivery cost	7 pence =	US$ 0.08
	106 pence =	US$ 1.23

MALTA ELECTRICITY BOARD

ACTUAL AND FORECAST - INCOME STATEMENT
(in thousands of Ls)

Fiscal Year Ending March 31	Actual		Forecast							
	1961[1]	1962[1]	1963[1]	1964	1965	1966	1967	1968	1969	1970
Kwhs sold - million	46.5	51.9	62.3	78.9	88.0	97.1	107.0	116.2	124.8	132.3
Average revenue per kwh (in pence)	4.03	3.23	3.07	2.94	2.94	2.92	3.06	3.06	3.06	3.06
Water sold (million gallons)						166	499	832	1,165	1,332
Average bulk price per 1,000 gallons (in pence)						105.8	94.7	86.5	83.5	82.6
Revenue from sales of electricity	781	698	797	965	1,078	1,180	1,364	1,482	1,591	1,687
Other electric operating revenues	151	76	76	58	60	62	65	68	72	75
Revenue from sales of water						73	197	300	405	458
Total revenue	932	774	873	1,023	1,138	1,315	1,626	1,850	2,068	2,220
Operating expenses	553	478	482	514	545	598	703	795	869	952
Depreciation	156	156	181	202	206	211	332	363	460	483
Total operating expenses	709	634	663	716	751	809	1,035	1,158	1,329	1,435
Operating income	223	140	210	307	387	506	591	692	739	785
Interest expense										
Proposed IBRD loan							147	142	137	131
Future foreign loans										110
Local borrowing										12
Total interest							147	142	137	253
Net profit				307	387	506	444	550	602	532
Payments on Government capital				317	317	317	349	349	349	349
Balance to surplus				(10)	70	189	95	201	253	183
Surplus or (deficit) beginning of year				-0-	(10)	60	249	344	545	798
Surplus or (deficit) end of year				(10)	60	249	344	545	798	981
Return on average net fixed assets in operation			4.2%	6.3%	8.2%	10.9%	9.4%	8.4%	7.8%	7.5%
Operating ratio	76%	82%	76%	70.0%	66.0%	61.5%	63.7%	62.6%	64.3%	64.6%
Operating ratio based on a three-year moving average	-	-	-	-	-	65.5%	63.6%	62.7%	63.5%	63.9%

1/ For 1960/61, 1961/62 and 1962/63 data refer to the Electricity Branch of the Water and Electricity Department.

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ANNEX 9

MALTA ELECTRICITY BOARD

Forecast of Sources and Application of Funds 1963 - 1970
(in thousands of Ls)

Fiscal year ending March 31 -	1964	1965	1966	1967	1968	1969	1970	3 Year Total 1963-66	4 Year Total 1967-70	7 Year Total 1963-70
				Estimated						
Sources of Funds										
Internal cash generation										
Operating income	307	387	506	591	692	739	785	1,200	2,807	4,007
Add depreciation	202	206	211	332	363	460	483	619	1,638	2,257
Total	509	593	717	923	1,055	1,199	1,268	1,819	4,445	6,264
Borrowings										
Proposed IBRD loan	648	1,069	962					2,679		2,679
Future foreign loan				667	1,000	333			2,000	2,000
Local borrowings						200			200	200
Total borrowings	648	1,069	962	667	1,000	533		2,679	2,200	4,879
Government capital	150	375						525		525
Total sources of funds	1,307	2,037	1,679	1,590	2,055	1,732	1,268	5,023	6,645	11,668
Application of Funds										
Construction expenditures (including capitalized interest)										
IBRD project	856	1,563	1,197					3,616		3,616
Future expansion project				760	1,130	1,028	350		3,268	3,268
Other construction	120	127	97	178	155	250	250	344	833	1,177
Total construction	976	1,690	1,294	938	1,285	1,278	600	3,960	4,101	8,061
Debt service										
Interest (other than capitalized)										
Proposed IBRD loan				147	142	137	131		557	557
Future foreign loan							110		110	110
Local borrowings							12		12	12
Total interest on non-permanent debt				147	142	137	253		679	679
Amortization										
Proposed IBRD loan				93	98	103	109		403	403
Future foreign loan							69		69	69
Local borrowings							5		5	5
Total amortization				93	98	103	183		477	477
Total debt service				240	240	240	436		1,156	1,156
Payments on Government capital	317	317	317	349	349	349	349	951	1,396	2,347
Total application of funds	1,293	2,007	1,611	1,527	1,874	1,867	1,385	4,911	6,653	11,564
Cash surplus or (deficit) during year	14	30	68	63	181	(135)	(117)			
Cash balance at beginning of year		14	44	112	175	356	221			
Cash balance at end of year	14	44	112	175	356	221	104			
Coverage of debt service (1)		2.12	2.47	1.71	2.20	2.42	2.75			

(1) Ratio of most recent year's operating income plus depreciation to maximum future debt service

ANNEX 10

MALTA ELECTRICITY BOARD

ESTIMATED BALANCE SHEET

(in thousands of Ls)

	4/1/63	3/31/64	3/31/65	3/31/66	3/31/67	3/31/68	3/31/69	3/31/70
Assets								
Fixed assets in operation - cost	4,980	4,980	5,100	5,227	8,940	9,741	12,191	12,791
Less accumulated depreciation	-	202	408	619	951	1,314	1,774	2,257
Fixed assets in operation - depreciated value	4,980	4,778	4,692	4,608	7,989	8,427	10,417	10,534
Work in progress	-	976	2,546	3,713	938	1,422	250	250
Total fixed assets	4,980	5,754	7,238	8,321	8,927	9,849	10,667	10,784
Net current assets	306	320	350	418	481	662	527	410
Total Assets	5,286 1/	6,074	7,588	8,739	9,408	10,511	11,194	11,194
Liabilities								
Proposed IBRD loan	-	648	1,717	2,679	2,586	2,488	2,385	2,276
Future foreign loan	-	-	-	-	667	1,667	2,000	1,931
Local borrowings	-	-	-	-	-	-	200	195
Total long term debt (other than Government capital)	-	648	1,717	2,679	3,253	4,155	4,585	4,402
Capital								
Government capital	5,286	5,436	5,811	5,811	5,811	5,811	5,811	5,811
Accumulated surplus or (deficit)	-	(10)	60	249	344	545	798	981
Total Liabilities and Capital	5,286	6,074	7,588	8,739	9,408	10,511	11,194	11,194
Debt/Equity ratio	0/100	11/89	23/77	31/69	35/65	40/60	41/59	39/61

1/ Depreciated book value of assets contributed by Government.

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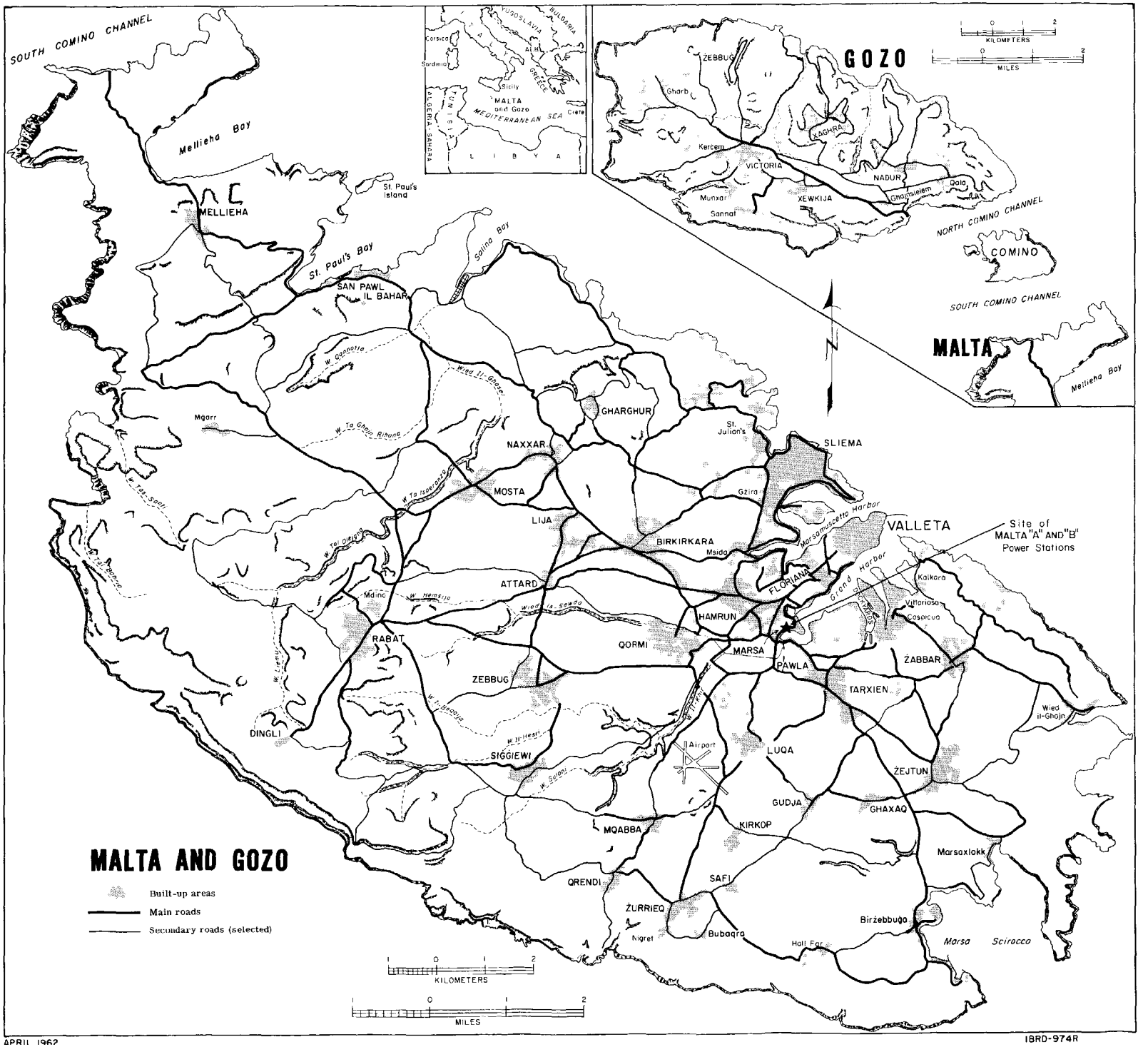

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