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INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT

APPRAISAL OF THE

SNOWY MOUNTAINS PROJECT

AUSTRALIA

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Department of Technical Operations

CURRENCY EQUIVALENTS

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AUSTRALIA

APPRAISAL OF THE SNOWY MOUNTAINS PROJECT

SUMMARY

i. The Commonwealth of Australia has asked the Bank for a loan of $100 million (£A44.6 million) to finance part of the Snowy Mountains Hydro-electric Authority's (SMA) 1961-1970 expansion program. The part proposed as a project for Bank financing is the Murray No. 1 hydroelectric scheme with an installed capacity of 760 MW. The project, which will also provide additional water for irrigation, is scheduled for completion in 1967 at an estimated cost of about $220 million.

ii. The borrower would be the Commonwealth of Australia which would in turn relend to the SMA.

iii. The project will make a needed contribution towards meeting the growth of power demands on the systems of NSW and Victoria State Electricity Commissions and the Canberra Electricity Supply. It will also make available about 470,000 acre feet of additional water for irrigation in the two States.

iv. The project is well engineered and technically sound. The estimated costs are reasonable and the construction schedule is realistic.

v. The SMA is well managed, its organization is sound, and it is fully capable of constructing and operating the project.

vi. Taking into account the irrigation benefits as well as savings in operating costs, the Murray hydroelectric development, of which the project forms part, is justified in comparison with the alternative of power generated by an equivalent thermal plant. The return on the additional investment, represented by these savings and benefits, would however be on the low side.

vii. All the electricity produced by the SMA is supplied in bulk to the State Electricity Commissions of New South Wales (NSW) and Victoria and to the Canberra Electricity Supply, a department of the Commonwealth Government responsible for the distribution of electricity in the Australian Capital Territory (ACT).

viii. The SMA is a non-profit making corporation. The basis on which its revenues are calculated is set out in an Agreement (the Snowy Mountains Agreement) between the Commonwealth and the states of New South Wales and Victoria.

ix. As the SMA sells its entire output to three consumers, it could be regarded as their generating agency. A notional consolidation of the forecast income statements of the SMA, the NSW and Victoria Electricity Commissions and the ACT indicates that the consolidated return on the total net fixed assets in operation would be on the low side at present but would increase to a reasonable level over the next few years.

x. The Bank would receive statements from the NSW and Victoria Commissions that their present satisfactory rate policies will be maintained.

xi. The project would be suitable for a Bank loan of $100 million equivalent for a period of 25 years, including a grace period of 4-1/2 years.

AUSTRALIA

APPRAISAL OF THE SNOWY MOUNTAINS PROJECT

I. INTRODUCTION

1. The Commonwealth of Australia has asked the Bank for a loan of $100 million (£A44.6 million) to finance part of the Snowy Mountains Hydroelectric Authority's (SMA) 1961-1970 expansion program. The part of the program proposed as the project for Bank financing is the Murray No.1 hydroelectric scheme with an installed capacity of 760 MW. The project, which will also provide additional water for irrigation, is scheduled for completion in 1967 at a total estimated cost of about £A100 million (about $220 million).

2. The borrower would be the Commonwealth of Australia which would in turn relend to the SMA.

3. This report is based on information submitted to the Bank by the Commonwealth and the SMA, and on the findings of a Bank mission which visited Australia in September and October 1961.

II. THE SNOWY MOUNTAINS SCHEME

4. In southeastern New South Wales and adjacent eastern Victoria a mountain range, known as the Great Dividing Range, rises to its highest elevation, forming the central section of the Australian Alps. Snow clad for five or six months each year, the area is the source of the Murray and Murrumbidgee rivers which flow westwards through dry but otherwise fertile plains for hundreds of miles to the coast of South Australia. Irrigation farming on these plains is a well established industry, yielding more food and other primary products than any other region in Australia.

5. The Snowy Mountains Scheme, begun in August 1949, to develop the hydroelectric power resources of the Snowy Mountains area and to supply additional water for irrigation in the Murray and Murrumbidgee valleys, provides for the diversion of water from the eastern river systems through trans-mountain tunnels to the western river systems. The scheme which is scheduled for completion in 1975 at a total estimated cost of £A400 million ($896 million), is divided geographically into two sections:

(a) The Eucumbene-Tumut development centered around the diversion of the Eucumbene river to the Tumut river, and

(b) The Snowy-Murray development centered around the diversion of the Snowy river to the Murray river.

The scheme is illustrated on Maps Nos. 1 and 2 attached.

6. The total capacity of hydroelectric plants to be installed is about 2,500 MW. The plants will be designed to operate as peaking plants with a total annual average energy output of about 5,000 million kwh, corresponding to a load factor of about 22%. This is the most economical way of utilizing the available water as the output of the scheme will be supplied to the NSW and Victoria Electricity Commissions whose systems have predominantly thermal generation. Up to June 30, 1961 capital expenditures on the scheme totalled £A181.2 million ($405.9 million) and considerable progress had been made.

7. Work on the Eucumbene-Tumut development commenced in 1949. The first two power plants of the scheme with a combined capacity of 600 MW are already in operation and the flow in the Murrumbidgee river has been augmented by about half a million acre feet per annum. When the development is completed there will be five power plants with a combined capacity of 1070 MW and the gain to the Murrumbidgee river will be over one million acre feet per annum.

8. The Snowy-Murray development, on which work started in 1958, is illustrated on Map No. 3. In 1970 when the first two power plants are in full operation it will provide 1,200 MW of power and will make available 830,000 acre feet per annum of water to the Murray river.

9. The estimated yearly expenditures on the scheme for the 9 years 1961/62 - 1969/70 are as follows:

(Millions of £A)

	61/62	62/63	63/64	64/65	65/66	66/67	67/68	68/69	69/70	Total
Murray No. 1	11.8	25.2	26.5	20.0	5.5	3.2	-	-	-	92.2
Murray No. 2	-	1.4	1.5	4.8	14.8	10.3	7.6	2.6	0.4	43.4
Murray and Tumut final stages	-	-	-	0.6	0.7	2.5	6.2	14.7	15.7	40.4
Total										176.0

($394 million)

III. THE SNOWY MOUNTAINS HYDROELECTRIC AUTHORITY

10. The SMA, a statutory corporation of the Commonwealth of Australia, was established in July 1949 by the Snowy Mountains Hydroelectric Power Act to carry out the Snowy Mountains Scheme. The Act defines the functions, powers and responsibilities of the SMA and the boundaries of the Snowy Mountains area.

The Snowy Mountains Hydroelectric Power Act

11. The Act provides that the SMA shall be constituted by a Commissioner appointed by the Governor General, shall be a Corporation sole with

perpetual succession and an official seal, capable of holding and disposing of real and personal property and of suing and being sued in its corporate name.

12. To enable the SMA to perform its functions, it is given powers by the Act to construct, maintain, operate, protect, manage and control works:

(a) for the collection, diversion and storage of waters in the Snowy Mountains area;

(b) for the generation of electricity in that area;

(c) for the transmission of electricity generated by the Authority;

(d) incidental or related to the construction, maintenance, operation, protection, management or control of any of the foregoing works.

The Snowy Mountains Agreement (the Agreement)

13. This Agreement, which was concluded between the Commonwealth and the two States of New South Wales (NSW) and Victoria late in 1957, became effective on January 1, 1959 when legislation approving it was finally passed by the parliaments of the three parties. The Agreement provides inter alia for:

(a) the constitution and functions of the Snowy Mountains Council, the operating body established by the Agreement on which the Electricity Commissions and Irrigation Authorities of NSW and Victoria are represented, together with the Commonwealth and the SMA;

(b) the control, diversion and sharing of waters for irrigation;

(c) the Commonwealth to reserve electricity for the Australian Capital Territory (ACT) from the output of the scheme, and for the balance to be allocated two-thirds to the Electricity Commission of NSW and one-third to the State Electricity Commission of Victoria.

14. The Act and the Agreement also specify the financial arrangements applicable between the Commonwealth and the SMA and between the SMA and the two State Electricity Commissions. These arrangements are discussed in the financial chapter of this report.

Organization and Management

15. The Commissioner, who is responsible to the Minister of the Commonwealth administering the Snowy Mountains Hydroelectric Power Act for the operation of the SMA, is assisted by two Associate Commissioners who are also appointed by the Governor General. To give continuity the Commissioner and the two Associate Commissioners were first appointed for period of 7, 6 and 5 years respectively. After the initial appointment each further appointment is for a period of 7 years.

16. The present Commissioner is an engineer and administrator of outstanding ability and wide experience who has held this position since the SMA was established in 1949. The SMA is well managed and efficiently organized to design and construct major engineering works. It has a well qualified and capable technical staff which has been built up over the past 12 years. On the basis of its past performance the Authority is fully capable of designing, constructing and operating the proposed project.

IV. THE MARKET FOR SNOWY MOUNTAINS HYDROELECTRIC POWER

17. The whole of the electricity production by the SMA will be supplied in bulk to the State Electricity Commissions of NSW and Victoria and to the Canberra Electricity Supply. The last is a department of the Commonwealth Government and distributes electricity in the Australian Capital Territory (ACT).

18. The two principal centers of population and industry in Australia, the metropolitan areas of Sydney and Melbourne, are in the States of NSW and Victoria respectively. Although the area of NSW and Victoria is only about 13.5% of the area of Australia over 65% of the country's population live there and nearly 70% of all the electrical energy produced in the Commonwealth is consumed in these two States. The Commonwealth capital, Canberra, is in the ACT which is a small area of 911 square miles situated in southeastern NSW with a population of about 65,000.

19. The Electricity Commission of NSW generates and transmits nearly all the electricity produced in NSW. It has an extensive transmission system covering a large part of the State and sells in bulk to distributing authorities (mainly local government bodies), to the State railways, and certain large industrial consumers. Power purchased by the Commonwealth from the SMA to meet the Australian Capital Territory's requirements is delivered over the Commission's transmission system and included in the Commission's sales statistics.

20. The State Electricity Commission of Victoria generates, transmits and distributes practically all of the electricity consumed in Victoria. Unlike the NSW Commission which sells mainly in bulk, most of its sales are to retail consumers.

Load Forecasts

21. Sales of electricity by the New South Wales Commission have increased from 1,121 million kwh in 1951/52, the first full year of operation, to 7,700 million kwh in 1960/61, and during the same period the system maximum demand has increased from 413 MW to 1,860 MW.

22. A forecast prepared by the NSW Commission shows that sales are expected to increase to 16,400 million kwh in 1969/70 representing an average

percentage increase per annum of 8.6% over the ten years from 1960/61. This forecast seems reasonable since the average percentage increase per annum over the last five years has been 11.1%. The system maximum demand, based on this forecast of sales, is expected to rise from 1,860 MW in 1960/61 to 4,060 MW in 1969/70, a total increase over the ten years of 2,200 MW.

23. The NSW Commission's installed generating capacity on June 30, 1961 was 2,170 MW, of which 2,037 MW was thermal plant and 133 MW hydro plant. In addition the Commission purchased 310 MW from the SMA. The planned allocation of power from the SMA for 1970 is 1,315 MW. The increase of 1,005 MW represents 46% of the expected increase in demand of 2,200 MW.

24. Sales of electricity by the Victoria Electricity Commission during 1960/61 totalled 5,286 million kwh, an increase of 7.8% over the previous year. Over the previous five years the average percentage increase per annum was 8.0%.

25. A forecast prepared by the Victoria Commission shows that sales are expected to increase to 10,052 million kwh in 1969/70 equivalent to an average percentage increase per annum of 7.4% over the ten years from 1960/61. This forecast is reasonable.

26. The maximum demand on the Victoria Commission's system during 1960/61 was 1,323 MW. An estimate based on the forecast of sales shows that the system maximum demand is expected to rise to 2,616 MW in 1969/70, a total increase of 1,293 MW over the ten years.

27. The Victoria Commission's installed capacity on June 30, 1961 was 1,577 MW, of which 1,217 MW was thermal plant and 360 MW hydroelectric plant. At that time the Commission purchased 120 MW from the SMA so that its total generating resources amounted to 1,697 MW. By 1970 it is planned that the SMA will supply 545 MW to the Victoria Commission and it will be noted that the increase of 425 MW between 1960/61 and 1969/70 amounts to 33% of the expected increase in demand of 1,293 MW during that period.

28. It is evident from these forecasts that, in addition to the increased supplies from the SMA, the two State Electricity Commissions will need to install substantial capacities of new generating plant, in order to meet their expected demands.

29. The supplies from the SMA to the NSW and Victoria Commissions would be peaking supplies afforded at the low load factor of about 22%. The 1,315 MW and 545 MW of power supplied to the two States in 1970 would, however, amount to only 32% and 21% of the respective maximum demands and, having regard to the system load characteristics, the supplies would make their full contribution towards meeting the requirements of the systems.

V. THE PROJECT

30. The project proposed for Bank financing is the Murray No. 1 hydro-electric development, with an installed capacity of 760 MW. This will be a peak load plant with an average annual output of 1,456 million kwh, corresponding to a load factor of about 22%. It will also provide additional water for irrigation in the States of New South Wales and Victoria by diverting water from the Snowy river to the Murray river. It is scheduled for completion in 1967. The output of the scheme will, however, be restricted to about 1,000 million kwh per annum until the Murray No. 2 scheme is completed in 1970.

31. As many features of the Murray No. 1 scheme are common to the No. 2 scheme, it is necessary to consider the whole Snowy-Murray development to obtain a clear picture.

32. The Snowy-Murray development is shown in Map No. 3. It provides for the diversion of the Snowy river by a tunnel through the Great Dividing Range to the Murray river catchment and the utilization of the diverted waters, augmented by the run-off from the western slopes, through two power plants, Murray No. 1 and No. 2. After utilization for generation of electricity the water will flow into the Swampy Plains river, a tributary of the Murray river.

33. The amounts of water available to the Murray Valley, which will increase progressively as each phase of the works is completed, are estimated as follows:

	('000 acre-feet)	
		Cumulative
1961	170	170
1967	300	470
1970	360	830

This water will, in accordance with the River Murray Waters Agreement, be shared equally between New South Wales and Victoria (except that whenever a "period of restriction" is declared by the River Murray Commission, South Australia will be entitled to a share).

34. In this development, the upper Snowy waters will be substantially controlled by the existing Lake Eucumbene. A concrete gravity dam and an inlet shaft will be built on the Snowy river at Island Bend with control structures to regulate and divert the flow either westwards to the Murray power plants, or for storage in Lake Eucumbene, to which the inlet shaft will be connected by a 15 mile long tunnel. This tunnel will be designed to permit flow in either direction so that water in excess of immediate requirements for power production in the two Murray power plants can be stored in Lake Eucumbene until required.

35. The inflows into the Snowy river downstream of Island Bend will be collected in a reservoir to be formed by the construction of a concrete gravity arch dam at Jindabyne. Water from the Jindabyne reservoir will be pumped up 700 feet into the tunnel system at Island Bend. The westward diversion will be achieved by a 9-mile long Snowy-Geehi tunnel connecting Island Bend pondage with a reservoir to be created by the construction of a rockfill dam on the Geehi river. The water from the Geehi reservoir will be used in two stages (Murray No. 1 and No. 2 power plants) to generate electricity utilizing the available fall of 2,600 feet between Geehi reservoir and the Swampy Plains river in the vicinity of Khancoban.

36. An earth and rockfill dam will be built at Khancoban forming a small reservoir to provide diurnal regulation of the release of water into the Swampy Plains river.

37. The average flow through the Murray power plants will be about 1,400 cusecs, of which about two-thirds will be derived by diversion from the eastern side of the range. The two power plants will operate under net heads of 1,610 feet and 900 feet respectively, their installed generating capacities being 760 MW and 440 MW. The stations' capacities have been determined on the basis of ultimately providing 22% load factor peak load electricity to the predominantly thermal systems of NSW and Victoria. Until the Jindabyne pump and storage scheme is completed in 1970, however, the Murray No. 1 power plant will operate on an average annual flow of approximately 1000 cusecs, which will be equivalent to a load factor of about 15%.

38. The project would comprise the Island Bend, Geehi and Khancoban dams, the Eucumbene-Snowy tunnel, the Snowy-Geehi tunnel, the Murray No. 1 power plant with eight 95 MW generating units, penstocks and tailrace channel, and a 330 kv substation (near the site of the future No. 2 power plant) to which the output of the plant would be delivered. Transmission at 330 kv from the substation to the vicinity of Melbourne and Sydney will be provided by the Victoria and NSW Electricity Commissions and constitutes an essential part of the project.

39. A more detailed description of the major works included in the project is given in Annex 1.

Status of Engineering

40. The SMA has a competent and experienced technical staff which plans, designs and supervises the construction of all works carried out by the Authority. The SMA retains leading consultants for discussion and advice on major engineering problems and it has had the benefit of a close association with the U.S. Bureau of Reclamation under the terms of an agreement between the U.S. Government and the Commonwealth on technical training and assistance. Under this agreement more than 100 of the Authority's engineers have received training for periods of 9-12 months in the U.S. and the Bureau has provided engineering designs and specifications for a significant part of the Authority's works. The assistance received from the Bureau has been invaluable in the past and the Authority will still be able to call on the Bureau should the necessity arise.

41. All work in connection with the planning and design of the project is practically completed. Preliminary work such as access roads, construction of camps, and site preparation, which is being carried out by the Authority's own labor force, started in 1958 and is now well advanced. Specifications have been prepared and bids invited, on an international basis, for all major works except the Murray No. 1 power plant structure and Khancoban dam. Bids have been received and contracts awarded for much of the civil works and for the generating plant and equipment.

Construction Schedules

42. Work on the Eucumbene-Snowy tunnel, the Snowy-Geehi tunnel and Island Bend dam is due to commence in December 1961. The first 95 MW set in Murray No. 1 power plant is scheduled for commissioning in March 1966 and all eight sets by May 1967. A bar chart of construction schedules is attached as Annex 2.

Estimated Cost

43. The total estimated cost of the project is £A99.2 million ($222.2 million). Of this total £A7.0 million was spent between July 1958 and June 30, 1961, leaving a balance of £A92.2 million ($206.5 million) to be spent during the period July 1, 1961 to June 30, 1967. The estimated cost of the principal features of the project are given in the following table. (A more detailed breakdown of costs is given in the project description in Annex 1.)

(£A millions)

	Foreign Exchange Costs	Local Costs	Total Costs
Civil Works	8.6	60.6	69.2
Electrical and Mechanical Plant and Equipment	5.1	5.1	10.2
Contract Supervision	-	2.8	2.8
Engineering and Administration	0.4	4.1	4.5
Contingencies	0.8	11.7	12.5
	14.9	84.3	99.2
Totals expressed in millions of $	33.4	188.8	222.2

44. The cost estimates are well-founded on the experience of the SMA with work already accomplished and in hand. The estimates are generous and this is illustrated by the fact that the unit prices in the civil contracts already awarded are up to 15% lower. With these margins the overall contingency allowance of about 14½% should be adequate to cover wage movements, possible changes in quantities and leave a reasonable provision for unforeseen difficulties.

45. The estimated year-by-year expenditures on the project are as follows:

	Spend to mid 1961	61/62	62/63	63/64	64/65	65/66	66/67	Total
£A millions	7.0	11.8	25.2	26.5	20.0	5.5	3.2	99.2
Equivalent $ millions	15.7	26.4	56.5	59.4	44.8	12.3	7.1	222.2

VI. ECONOMIC JUSTIFICATION

46. As many features of the Murray No. 1 scheme (the project) are common to the No. 2 scheme, it is necessary to consider the whole of this development when making a comparison of the cost of hydroelectric power produced with the cost of alternative thermal power produced by the NSW and Victoria Electricity Commissions. Although the SMA do not receive any payment for water provided for irrigation, the whole of the cost of the Snowy Scheme being charged to power, irrigation benefits will be obtained due to the additional water made available. It is therefore necessary when comparing the cost of power provided by the Murray development with alternative thermal power to take these benefits into account.

47. The Murray development is scheduled for completion in 1970. By this time both the No. 1 and No. 2 power plants should be in full production and all the additional water made available which is likely to be used in the foreseeable future should be utilized. A calculation of the economic return for the year 1970 has therefore been made and this is shown in Annex 3. It is assumed that the benefits used in this calculation will at a minimum remain stable thereafter.

48. The calculation can be summarized as follows:

	£A millions	
Additional investment in Murray hydroelectric development and irrigation works compared with thermal alternative	87.7	
Savings in operation and maintenance of Murray development in comparison with thermal alternative	3.77	
Net benefit from additional irrigation	1.10	
Total Benefit	4.87	
Total benefit as return on additional investment		5.6%

49. This clearly is not an impressive return and is marginal for a country like Australia. It is not so low, however, that the project could be considered economically unjustified in view of the conservative nature of the calculations. The irrigation benefits may well prove to be somewhat greater than stated.

VII. FINANCIAL ASPECTS

Financial Provisions of the Snowy Mountains Hydroelectric Power Act and the Agreement

50. The Act and the Agreement embody a complex set of financial provisions, the most salient of which, as presently in effect, may be summarized as follows:

(a) The SMA obtains all its funds in the form of advances from the Commonwealth Treasury. The rate of interest and the term of these loans are the average interest rate and maturity of long-term Commonwealth Government bonds last raised in Australia (currently 5-3/8% interest, 20-year term).

(b) Payment of interest and amortization on Commonwealth advances for a given stage of the Snowy scheme begins when the stage is transferred, on the Authority's balance sheet, from Work in Progress to "Stages in Operation".

(c) Interest is neither paid nor compounded until the stage is thus brought into account. The sum of the annual figures of interest accrued is then carried to a special "accumulated interest" account, kept separate from the physical cost of the installations.

(d) Amortization payments are made up of two different parts:

(i) Advances are amortized on a 70-year sinking fund basis, compounded at the same rate of interest as is charged on the advances. (Since the advances are made initially for only 20 years, the unamortized balance must thus be refunded at 20-year intervals.)

(ii) The "accumulated interest" account is amortized on a straight-line basis over 70 years without compounding. SMA pays to the Treasury 1/70 of the account every year from the time a stage is brought into account.

(e) Charges for electricity delivered to New South Wales, Victoria and the ACT are intended to reimburse the Authority for all its "net cost of production" including interest and depreciation, which is equal to amortization payments. The Authority is a non-profit-making corporation.

Financial Situation of the Snowy Mountains Authority

51. As revenues of the Authority cover its costs without providing for a surplus, the return on its total investment after all stages are brought into account will tend to equal the average rate of interest paid on all Commonwealth advances (at least 5.2%).

52. In the period during which SMA carries on both construction and operation activities, the return will remain much lower. This is because of the waiver of payment of interest during construction and the deferment of debt service payments until stages are brought into account. At June 30, 1961, for example, a total of only £A32 million had been brought into

account, compared to an estimated £A120 million of assets in operation. This time lag results in an abnormally low "net cost of production" and selling charge which, in turn, depresses the return on the Authority's true investment in assets in operation.

Return on Investment of the SMA's Power Facilities

53. As previously stated (para. 46) SMA will not charge for irrigation water. The whole cost of the scheme is thus allocated to power. In assessing the return represented by the net income from the sale of power, however, it would be more reasonable to base the calculation on the necessary investment if the scheme had been designed solely for power production.

54. Although an accurate allocation of construction expenditures between power and irrigation features is not possible, the Authority has estimated that, if the scheme had been constructed for power only, its cost would have been 15%, or £A60 million, lower. Considering the average cost of headworks per acre-foot of storage waters for irrigation in Australia, this figure of £A60 million appears reasonable.

55. In the following computations of financial returns on power investment, 15% has accordingly been deducted from the total cost of the Snowy Scheme in respect of irrigation.

56. Summary revenue accounts of SMA for the past two years and a forecast for the next 9 years are shown in Annex 4. For the past two years the return has been less than 1%. It is expected to increase gradually from 1.6% in 1962 to 4.8% in 1970. After 1970, the return would continue to rise slowly, as successive stages are brought into account, reaching about 6.1% in 1976 after full completion of the scheme.

Consolidated Return of SMA, ACT and the State Commissions

57. These returns are low but too much significance should not be attached to them since, as mentioned earlier, the SMA is a non-profit making corporation which sells its entire production to the two State Commissions and to the ACT. In effect, therefore, the Authority could be regarded as a generating agency for the three bulk consumers.

58. It would accordingly be logical to consider notionally a consolidated statement of income and expenses for the four entities, in relation to their aggregate investment (excluding the expenditures incurred by the SMA which could be reasonably allocated to irrigation).

59. This consolidated statement is shown in Annex 5. Summaries of the capitalization and recent earnings of the State Electricity Commissions of NSW and Victoria are given in Annexes 6 and 7.

60. The estimates of revenues of the two State Commissions and the ACT are based on the estimated sales growth discussed in paras. 21 to 27. For the purpose of this computation, interest has been capitalized. Depreciation of all assets has been taken on a uniform straightline basis assuming

a life of 65 years for hydro and 30 years for thermal. This is in line with present practice in Victoria, but differs from the depreciation charged by SMA and by the NSW Electricity Commission.

61. On this basis, the consolidated return on net investment in operation would increase from the present 5.4% to about 7.4% in 1965 and to 8% in 1970. The return would rise to 8.5% by 1976, after completion of the entire scheme.

62. It is expected therefore that the consolidated return, although low at present, will reach a reasonable level over the next few years. The two State Commissions are anxious to provide a substantial part of their capital requirements out of earnings and depreciation and have stated their intention to maintain their rate policies accordingly.

VIII. CONCLUSIONS

63. The SMA is well managed, with a sound organization, and is fully capable of constructing and operating the project (see paras. 15 and 16).

64. The project is well engineered and technically sound. The estimated costs are reasonable and the construction schedule is realistic (see paras. 40-44).

65. The project will make a needed contribution towards meeting the growth of power demand on the systems of the NSW and Victoria State electricity Commissions and of the ACT. It will also make additional water available for irrigation in the two States (see paras. 21-33).

66. Taking into account the irrigation benefits as well as the savings in operating costs, the project is justified in comparison with the alternative of power generation by an equivalent thermal installation. The return on the additional investment, represented by these savings and benefits, is estimated to be around 5-1/2% (see paras. 46-49)

67. As the SMA sells its entire output to NSW and Victoria State Electricity Commissions and to the ACT, at its net cost of production, it could be regarded as the generating agency of these three bulk consumers. Accordingly it would be logical to consider a notional consolidation of the forecast income and expenses of these four entities in relation to their aggregate investment. The consolidated return on the total net fixed assets in operation, while only 5.4% at present, can be expected to rise to 7.4% in 1965 and 8% in 1970.

68. The project is considered suitable for a Bank loan of $100 million equivalent for a period of 25 years, including a grace period of 4-1/2 years.

ANNEX 2

DETAILED DESCRIPTION OF THE PROJECT

The Murray No. 1 scheme (the project) is illustrated on Map No. 3. The major works of the scheme and their purpose are as follows:

Eucumbene-Snowy Tunnel

This tunnel will be approximately 78,000 feet (about 15 miles) in length and will have a nominal cross sectional area of 350 square feet in the unlined sections. The tunnel, which will be unlined for the major part, will be horse-shoe in shape with a concrete paved invert throughout. The general level of the tunnel will be approximately at elevation 3500 feet above sea level. It will connect the 270 feet deep intake shaft at Island Bend Dam with the existing outlet works tunnel constructed through the right abutment of Eucumbene Dam.

The purpose of this tunnel is two-fold. Firstly, it will enable the waters of the Snowy River at Island Bend to be diverted to Lake Eucumbene for storage when these inflows are surplus to immediate requirements for power generation in the Murray power plants. Secondly, it will be used in conjunction with the Snowy-Geehi tunnel to convey stored water from Lake Eucumbene to the power plants when required. An intermediate intake shaft about 3 miles along the tunnel from Island Bend intake shaft will collect the waters of the Burrungubugge and Gungarlin Rivers.

Island Bend Dam

The dam will be a concrete gravity structure, about 150 feet in height and with a crest length of 470 feet. It will have a central gated overfall spillway. The storage capacity of the pondage created by the dam will be about 2,500 acre feet.

The purpose of this dam is to serve as a diversion structure, providing minor storage during periods of high inflow and at the same time increasing the head available for the diversion of Snowy water to Lake Eucumbene. The full supply level of the pondage will be at elevation 3,890 feet, which is about 68 feet above the ultimate full supply level of Lake Eucumbene.

Snowy-Geehi Tunnel

This tunnel, which will connect the Island Bend works to the Geehi reservoir, will be horse-shoe in shape, approximately 48,000 feet (about 9 miles) in length, and will have a nominal cross sectional area of 350 square feet in the unlined sections. The tunnel will be concrete lined for short distances at each end, at tunnel junctions, and at other places where required. A concrete invert slab will be placed in unlined sections.

This tunnel, which will be at an elevation of about 3,500 feet, will enable water to be diverted from east to west. It will connect with

the Eucumbene-Snowy tunnel and thus with Lake Eucumbene, the central storage of the Snowy Scheme, and later with the tunnel from the head of the rising main from the Jindabyne pumping station which will be constructed as part of the Murray No. 2 scheme.

Geehi Dam

This will be a rock-fill dam with a thin earth core. It will be 300 feet high and have a crest length of approximately 970 feet. The spillway will be of the morning glory type with a bell mouth 105 feet in diameter. The concrete lined spillway tunnel 29 feet in diameter and about 840 feet in length will discharge well clear of the toe of the dam. A diversion tunnel 20 feet in diameter through the right abutment of the dam will house the outlet works after the dam is completed. The full supply level of the dam will be at elevation 3,630 feet, and the capacity of the reservoir formed by the dam will be 17,300 acre feet.

Geehi reservoir will serve a double purpose. It will collect the waters flowing from the upper Geehi River and from aqueducts in Bogong Creek and Geehi River areas, and it will also balance the inflow from the Eucumbene-Snowy-Geehi diversion system with the intermittent water requirements of the Murray No. 1 power plant.

An outlet-inlet structure will be constructed in the reservoir to allow water from the Snowy-Geehi tunnel to flow into the reservoir and also to enable water to be drawn from the reservoir through the Murray No. 1 pressure tunnel to the Murray No. 1 power plant.

Murray No. 1 Pressure Tunnel

This tunnel will be approximately 39,000 feet (about 7.5 miles) in length. It will connect the outlet-inlet structure in the Geehi reservoir to the guard valves at the head of the Murray No. 1 pressure pipeline.

The tunnel will be fully concrete lined and will be mostly of horse-shoe section, with a nominal cross sectional area of 420 square feet. A section of circular tunnel 1,280 feet long with a cross sectional area of 400 square feet will pass under Bogong Creek and 860 feet of similar circular section will be constructed at the surge tank connection. The tunnel will bifurcate into twin circular reinforced concrete lined tunnels 13 feet 9 inches in diameter and 620 feet long, of which the downstream 450 feet will be steel lined. The steel lining will be connected to guard valves at the pressure tunnel outlet portal.

The purpose of the pressure tunnel is to convey water from the Geehi reservoir to the pressure pipelines serving the Murray No. 1 power plant. It will also collect water from the Bogong, Cascade and other creeks.

Murray No. 1 Pressure Pipelines

These pipelines will convey water from the downstream-end of the pressure tunnel to the Murray No. 1 power plant. There will be two steel pipelines, each approximately one mile in length and varying in diameter from 13 feet 9 inches at the portal to 11 feet 9 inches at the power plant distribution manifold, where each pipeline will divide to supply four turbines. The pipelines will be subject to a maximum static head of 1,720 feet.

Murray No. 1 Power Plant

The power plant will be located on the right bank of Khancoban Back Creek about 7 miles by road from Khancoban. The generating plant will consist of eight 95 MW Francis type turbo-alternators designed to operate with a net head of 1,610 feet, which will be installed in a machine hall 470 feet long, 60 feet wide and 110 feet high. Water from the turbines will discharge into a tail bay and then by open channel into Khancoban Back Creek.

The output of the turbo-alternators will be stepped up from 15 kv to 330 kv and delivered by double circuit overhead transmission lines to a substation which will be located near the site of the future No. 2 power plant.

Transmission lines operating at 330 kv will be provided by the NSW and Victoria Electricity Commissions to deliver the output of the plant from the substation to the vicinity of Sydney and Melbourne.

Khancoban Dam

This dam will be constructed on the Swampy Plains River just downstream of Khancoban Creek. It will be an earth and rock fill dam, 60 feet high, and will have a crest length of 3,500 feet. The storage capacity of the reservoir created by the dam will be 20,000 acre feet. A concrete structure for the spillway and the outlet works will be constructed on the river section.

The purpose of this reservoir will be to regulate the fluctuating releases from the Murray power plants to provide a practically uniform outflow into the Swampy Plains River. The SMA is required to do this by the Snowy Mountains Agreement.

The Estimated Cost of the Project

The total estimated cost of the project is £A99.2 million ($222.2 million). A breakdown of the cost is given in the following table.

ESTIMATED COST OF THE PROJECT
(LA Millions)

	Eucumbene-Snowy Tunnel			Snowy-Geehi Tunnel and Island Bend and Geehi Dams			Khancoban Dam and Ancillary Works			Murray No. 1 Pressure Tunnel, Pressure Pipelines and Power Plant			Totals		
	Foreign Exchange Costs	Local Costs	Total Costs	Foreign Exchange Costs	Local Costs	Total Costs	Foreign Exchange Costs	Local Costs	Total Costs	Foreign Exchange Costs	Local Costs	Total Costs	Foreign Exchange Costs	Local Costs	Total Costs
Civil Contracts	2.1	14.8	16.9	2.3	16.2	18.5	0.2	1.5	1.7	2.5	17.2	19.7	7.1	49.7	56.8
Other Civil Works	0.3	2.2	2.5	0.3	2.3	2.6	-	0.5	0.5	0.9	5.9	6.8	1.5	10.9	12.4
Electrical and Mechanical Equipment	0.2	0.3	0.5	0.1	0.1	0.2	1.0	1.2	2.2	0.1	0.2	0.3	1.4	1.8	3.2
Generating Plant	-	-	-	-	-	-	-	-	-	3.7	3.3	7.0	3.7	3.3	7.0
Contract Supervision	-	0.8	0.8	-	0.9	0.9	-	0.1	0.1	-	1.0	1.0	-	2.8	2.8
Engineering Design and Administration	0.1	0.8	0.9	0.1	0.8	0.9	-	0.2	0.2	0.2	2.3	2.5	0.4	4.1	4.5
Contingencies 1/															
Civil Works	0.2	2.8	3.0	0.2	3.2	3.4	-	0.4	0.4	0.3	4.0	4.3	0.7	10.4	11.1
Electrical and Mechanical Plant and Equipment	-	0.1	0.1	-	-	-	-	0.3	0.3	0.1	0.9	1.0	0.1	1.3	1.4
	2.9	21.8	24.7	3.0	23.5	26.5	1.2	4.2	5.4	7.8	34.8	42.6	14.9	84.3	99.2
Totals expressed in Millions of US$	6.5	48.8	55.3	6.7	52.6	59.3	2.7	9.4	12.1	17.5	78.0	95.5	33.4	188.8	222.2

Rate of Exchange LA1 = $2.24

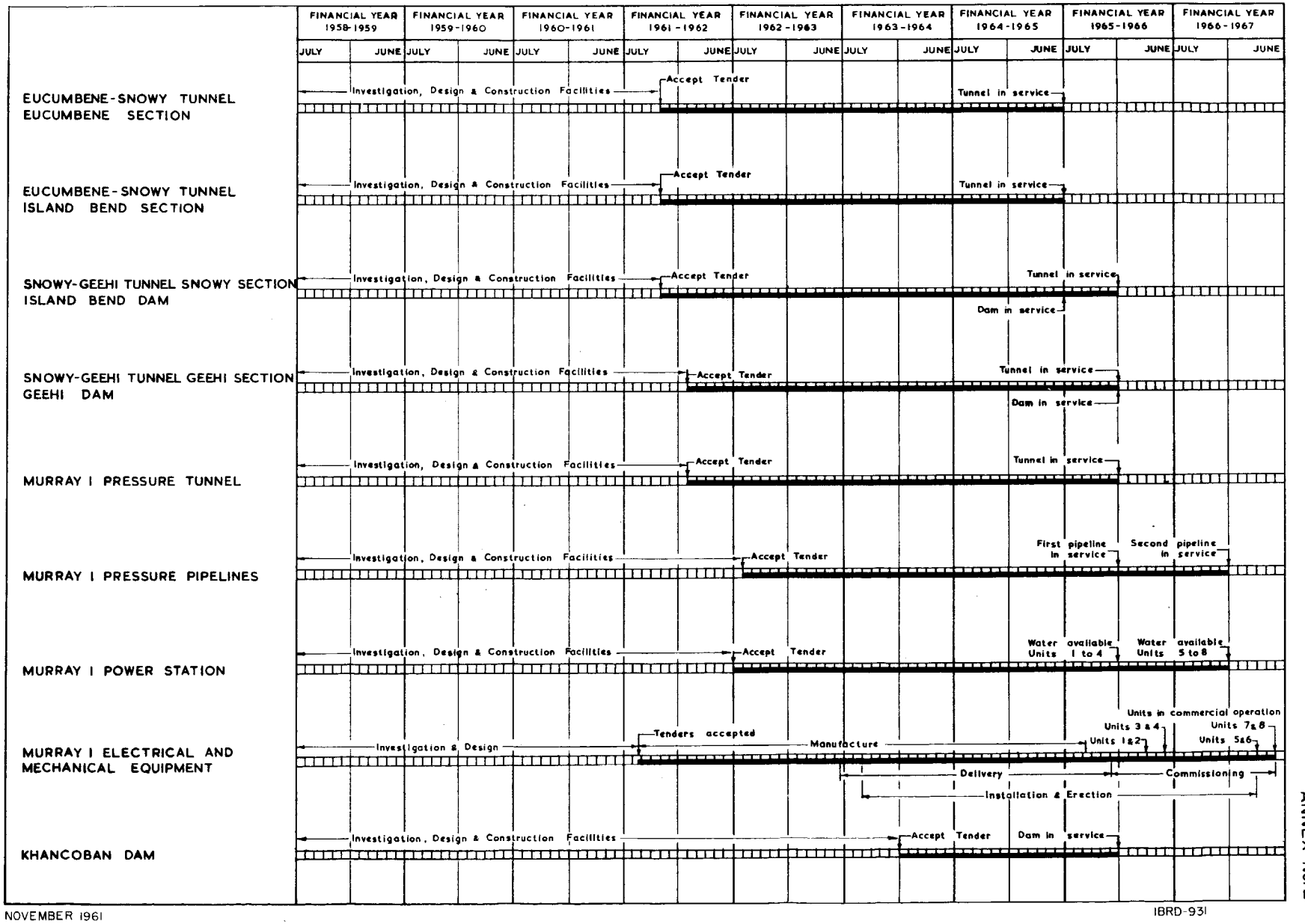
1/ Contingencies calculated as follows:

Overall	- 14.4%
Civil Works	- 16.0%
Mechanical and Electrical Plant and Equipment	- 13.7%

AUSTRALIA

SNOWY MOUNTAIN HYDROELECTRIC AUTHORITY

CONSTRUCTION SCHEDULE



NOVEMBER 1961

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ANNEX No. 2

ANNEX 3

ECONOMIC JUSTIFICATION

To compare the cost of hydroelectric power with the cost of alternative thermal power produced by the NSW and Victoria Electricity Commissions, it is necessary to consider the whole Murray development as many features of the No. 1 Scheme are common to the No. 2 Scheme. Although the whole of the cost of the Snowy Scheme is being charged to power, irrigation benefits are obtained due to the additional water provided. It is therefore necessary when comparing the cost of power produced by the Murray development with alternative thermal power to take these benefits into account.

The Murray development is scheduled for completion in 1970. Both power plants should then be in full production and all the additional water made available for irrigation, which is likely to be used in the foreseeable future, should be utilized. A comparison of costs in 1970 has therefore been made.

The Murray No. 1 and 2 power plants will have a combined installed capacity of 1200 MW. The plants will be operated as peak load plants with an average annual load factor of about 22% and an estimated average annual output of 2290 million kwh. This output will be divided between the NSW and Victoria Electricity Commissions in accordance with the provisions of the Snowy Mountains Agreement. The allocation in 1970 will be:

	MW	Kwh (millions)
NSW Electricity Commission	860	1650
State Electricity Commission of Victoria	340	640
	1200	2290

It would, of course, be necessary for the Commissions to install additional generating capacity to give the above outputs in 1970 if the Murray Schemes were not built.

In making the comparison of the cost of hydroelectric and alternative thermal power the following basic principles have been applied:

Interest during construction has been capitalized at 5-1/2% per annum.

Depreciation has been calculated on a sinking fund basis at 5-1/2% interest over a period of 30 years for thermal plants and 65 years for hydroelectric plants.

Cost of Hydroelectric Power

The estimated capital costs of the Murray No. 1 and 2 Schemes including the cost of transmission lines from the power plants to the load centers in NSW and Victoria are given in the following table. The cost

of these transmission lines, although met by the two Commissions, is a part of the cost of the two Schemes.

	Capital Cost (£A millions)		
	Excluding Interest during Construction	Interest during Construction	Total Cost
Murray No. 1 Scheme	99.2	16.5	115.7
Murray No. 2 Scheme	41.9 1/	7.2	49.1
Transmission Lines from the Power Plants to Load Centers:			
in NSW	5.0	.6	5.6
in Victoria	5.4	.4	5.8
Totals	151.5	24.7	176.2

1/ The difference between this figure and the £A43.4 million appearing in para. 9 of the report covers housing which has been excluded from this comparison because, at a minimum, an equivalent amount of housing would be required for the alternative thermal installations.

The estimated annual operating and maintenance costs of the two Schemes and the transmission lines is £A0.81 million. These costs are based on the cost of operating existing installations. The annual depreciation calculated on a sinking fund basis at 5-1/2% interest over a 65-year period is £A0.32 million.

Cost of Alternative Thermal Power in NSW

Considering next the situation in NSW where plant to provide 860 MW and 1650 million kwh would be required. Allowing for differences in plant availability and auxiliary power requirements the installed capacity of thermal plants to give an output of 860 MW would be 1010 MW.

The estimated capital costs of 1010 MW of additional thermal capacity and of transmission lines from the power plants to the main load center are given in the following table.

	Capital Cost (£A million)		
	Excluding Interest during Construction	Interest during Construction	Total Cost
Generating Plant (1010 MW)	54.3	8.6	62.9
Transmission Lines	3.1	.5	3.6
Engineering & Administration	4.8	-	4.8
Total	62.2	9.1	71.3

As the new thermal plant would consist of large highly efficient units the most economical way of operating the system would be to use these units to supply base load and use some of the existing less efficient plant to supply peaking power. The additional annual operating and maintenance costs in 1970 under these conditions are estimated to be:

Additional System Fuel Costs	£A1.28 million
Additional Operating & Maintenance Costs	£A1.34 "
Total	£A2.62 million

The annual depreciation calculated on a sinking fund basis at 5-1/2% interest over a 30 year period would be £A0.98 million.

Cost of Alternative Thermal Power in Victoria

Considering now the situation in Victoria where plant to provide 340 MW and 640 million kwh would be needed, an installed capacity of 400 MW would be required to give an output of 340 MW.

The estimated capital costs of 400 MW of additional thermal capacity and of transmission lines from the power plant to the main load center are given in the following table:

	Capital Cost (£A million)		
	Excluding Interest during Construction	Interest during Construction	Total Cost
Generating Plant (400 MW)	26.6	3.8	30.4
Transmission Lines	3.9	0.1	4.0
Total	30.5	3.9	34.4

As in the case of NSW the new thermal plant would consist of large high efficiency units. The most economical way of operating the system would be to use these units to supply base load and to use older and less efficient units to supply peaking power. The additional annual operating and maintenance costs in 1970 under these conditions are estimated to be:

Additional System Fuel Cost	£A0.13 million
Additional Operating & Maintenance Costs	£A0.70 "
Total	£A0.83 million

The annual depreciation calculated on a sinking fund basis at 5-1/2% interest over a 30 year period would be £A0.47 million.

Irrigation Benefits

It is estimated by 1970 the Snowy-Murray scheme will make available 830,000 acre feet per annum of additional water to the Murray river.

Before it can be used on the land it will have to travel long distances to the main river off-takes ranging from 145 river miles to 355 river miles, and then long distances again through the main and secondary canals to the irrigation areas. After making allowances for losses due to seepage and evaporation and for South Australia's entitlement,1/ 830,000 acre feet released from storage would become 600,000 acre feet at diversion points. Of this, 300,000 acre feet would go to NSW and 300,000 acre feet to Victoria.

After distribution losses between diversion points and farm fields, NSW's 300,000 acre feet would become 225,000 acre feet available for effective application in the field, and Victoria's 300,000 acre feet would become 160,000 acre feet (the severe reduction in Victoria being mainly due to the old and inefficient distribution system of Torrumbarry).

NSW already has almost sufficient water available in the Murray to provide for the development planned in this area. Unless there were some drastic and unexpected changes from the present plans, little if any of the additional Snowy-Murray water would be used in NSW within the next 10 to 15 years. No direct benefits from the additional water in this State have therefore been assumed.

In Victoria, however, it can be assumed that as soon as additional water from the Snowy-Murray diversion is available it will be taken up readily and used effectively by Victoria irrigation farmers in the Murray Valley and Torrumbarry Irrigation District. It is estimated that to make use of the additional water in Victoria, public investment, mainly for remodelling supply channels, of £A1 million would be required and farmers would have to invest about £A6.5 million on their farms.

The Murray Valley irrigation area comprises 268,000 acres with good soils and regular topography well suited to irrigation farming. The area irrigated in 1959/60 was 110,000 acres out of a total of 207,000 acres classified as suitable for irrigation. The Torrumbarry irrigation area comprises 341,000 acres ranging from light sandy loams to fairly heavy clays. In 1959/60, 238,000 acres were irrigated, out of a total of 300,000 acres classified as suitable for irrigation. In both areas there is considerable need for more irrigation water than is at present available.

In both the Murray Valley and Torrumbarry areas the main types of agricultural production are dairying (40-50%), fruits and vegetables (25-35%), meat and wool (18-19%). When the additional water becomes available for irrigation the farmers will be free to decide how to use it; it is impossible to be certain what the pattern of livestock and cropping will be; the pattern might change with changing incentives. There could well

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1/ During "periods of restriction" (which may be declared by the River Murray Commission when certain prescribed conditions prevail) South Australia becomes entitled to three-thirteenths of the flow passing a specified point (Albury) irrespective of its source; an unidentifiable part of the water flowing past Albury would be derived from the Murray development.

be some development of crops, such as cotton, oilseeds or tobacco if these should be proved more profitable, but for the purposes of estimating, it has been assumed that the whole of the additional water would be used for increasing the present main products of the districts (i.e. dairy produce, vegetables, fruit, meat, wool).

Since Australia already produces sufficient of all these commodities to supply local consumption and a surplus for export, the value placed on the additional production from the use of Snowy-Murray water has not been calculated on internal, equalized prices (or, in the case of butter and cheese, subsidized prices) received by the farmer, but on export prices which are lower. The export prices have been calculated back to the value of each commodity at the farm. In the case of butter, the price used is 24 pence per pound commercial butter (comparable internal price received by producers in Australia, 46.5 pence); fat lambs have been valued at 55 shillings each (comparable internal price 65 shillings); and fruit has been valued on the basis of the Australian Canned Fruit Board's guaranteed prices to growers marked down to take account of the poorer market prospect expected in the future: peaches, £A45 per ton (£A49); pears £A40 per ton (£A44), and apricots £A30 per ton (£A34). The figures in brackets after each of the values used for fruit are the prices paid to growers by the Australian Canned Fruit Board in 1959/60.

At these export prices the gross value of the increased production is estimated at £A3.7 million. After deducting farm costs of £A2.6 million (calculated from data provided by the Australian Bureau of Agricultural Economics based on official cost-of-production surveys) the net value of increased production would be £A1.1 million.

It should be pointed out that the net value of increased production stated above has been calculated on generally conservative assumptions, and that there would in addition be some benefits which it has not been possible to quantify:

(1) Benefits to South Australia: There would be a greater assurance of supply in normal times and also a better supply than would otherwise be available during "periods of restriction" when South Australia would be entitled to a share of the additional waters of the Snowy-Murray diversion. The improved supply is not likely to be used directly for increasing the area under irrigation but would be important in reducing the salinity of the water available to areas already irrigated.

(2) Benefits to NSW: Although no direct benefit has been assumed from the 300,000 acre feet available to NSW because at present there is no planned development for the use of the water, this situation will eventually change. There is little doubt that in the long term it will be put to use by the NSW Government. In the short term there may be some casual use of the water by irrigators on both sides of the river.

Economic Return Calculation

A calculation of the return on the additional investment in the Murray Hydroelectric Development as compared to alternative thermal installations as of 1970 is given below:

	(£A Millions)	
Capital Costs		
Murray Hydroelectric Development	176.2	
Investment in irrigation works in State of Victoria by Government and Farmers	7.5	
Total - Murray Hydro and irrigation		183.7
Alternative thermal installations:		
New South Wales	71.3	
Victoria	34.4	
Total alternative thermal investment		105.7
Total additional investment in Murray Hydro and irrigation works		78.0
Capitalized Cost of Interest less the Value of Benefits between 1967 and 1970.1/		
Interest cost on Murray No. 1	16.0	
Interim savings in thermal operation 4.9		
Interim Benefits from Irrigation 1.4		
Less: Interim Savings & Benefits	6.3	
Net Capitalized Cost for period 1967-1970		9.7
Total additional capital investment as of 1970		87.7

1/ The benefits used in this calculation refer to the calendar year 1970 and are assumed to remain stable thereafter. Actual benefits are expected from the projected date of completion of the project June 30, 1967. Such benefits have been capitalized inclusive of interest earned for the 2-1/2 year period prior to 1970. Similarly, the interests cost on the capital invested in the Murray No. 1 plant has been capitalized for the same 2-1/2 years which covers the period from its completion to 1970. Interest prior to 1967 has been included as interest during construction. Interest costs on Murray No. 2 and the thermal alternative have been included up to 1970 as interest during construction. In this way, all benefits and capital costs have been placed on the same time basis (i.e. the calendar year 1970).

(£A Millions)

Operating Costs of Power Productions		
Murray Hydro:		
Operation and maintenance	0.81	
Depreciation	0.32	
Total		1.13
Alternative thermal installations:		
New South Wales:		
Fuel, operating and maintenance	2.62	
Depreciation	0.98	
Total - New South Wales	3.60	
Victoria:		
Fuel, operating and maintenance	0.83	
Depreciation	0.47	
Total Victoria	1.30	
Total operating costs - Thermal		4.90
Savings in operation costs with Murray Hydro		3.77
Irrigation		
Gross value of increased production	3.70	
Increase in operating and maintenance cost and depreciation	2.60	
Net Irrigation Benefit		1.10
Total power and irrigation benefits		4.87

These total benefits are equivalent to a return of 5.6% on the total additional investment of £A87.7 million.

SNOWY MOUNTAINS AUTHORITY

Revenue Account

(in millions of £A)

		Actual		Estimated								
		59/60	60/61	61/62	62/63	63/64	64/65	65/66	66/67	67/68	68/69	69/70
Revenues from sales of power		1.36	1.56	3.21	7.17	7.17	7.17	7.87	10.53	10.63	14.14	16.92
Operation and maintenance		.28	.30	.40	.51	.51	.51	.60	.87	.87	1.09	1.32
Depreciation (70-year sinking fund)		.19	.19	.23	.29	.29	.29	.29	.45	.45	.45	.52
Gross income	(A)	.89	1.07	2.58	6.37	6.37	6.37	6.98	9.21	9.31	12.60	15.08
Average net fixed assets in operation*	(B)	114.2	127.2	156.6	173.5	173.5	173.1	229.5	269.7	270.7	291.7	312.9
Return $\frac{A}{B}$		.8%	.8%	1.6%	3.7%	3.7%	3.7%	3.0%	3.4%	3.4%	4.3%	4.8%

ANNEX 4

* The computation of net fixed assets in operation includes a notional allowance for capitalized interest

ANNEX 5

CONSOLIDATED STATEMENT OF REVENUES AND EXPENSES

**Snowy Mountains Authority,
the Electricity Commissions of NSW and Victoria
and the ACT**

(in millions of $A)

	1959/60	1960/61	1961/62	1962/63	1963/64	1964/65	1965/66	1966/67	1967/68	1968/69	1969/70
Total Revenues											
New South Wales	48.16	52.40	55.54	56.72	61.83	67.14	72.36	69.37	75.31	81.96	88.95
Victoria	50.43	55.34	58.70	64.70	67.20	72.60	77.30	82.20	87.70	93.10	98.70
Australian Capital Territory	1.20	1.37	1.58	1.81	2.08	2.39	2.70	3.05	3.45	3.89	4.39
A Total Revenues	99.79	109.11	115.82	123.23	131.11	142.13	152.36	154.62	166.46	178.95	192.04
Operating Expenses											
Snowy Mountains Authority	.28	.32	.40	.51	.51	.51	.60	.87	.87	1.09	1.32
New South Wales	28.83	30.69	30.14	29.81	31.43	32.51	32.75	31.35	33.34	35.48	37.72
Victoria	27.08	29.65	31.85	31.52	31.90	33.30	35.40	35.80	36.80	38.00	39.80
Australian Capital Territory	.19	.20	.23	.26	.29	.33	.38	.43	.53	.60	.68
B Total Operating Expenses	56.38	60.86	62.62	62.10	64.13	66.65	69.13	68.45	71.54	75.17	79.52
Depreciation											
Snowy Mountains Authority	.67	1.75	1.78	2.69	2.69	2.69	2.69	4.16	4.18	4.21	4.22
New South Wales	7.90	7.95	8.10	9.00	9.80	10.60	11.50	12.40	13.40	14.20	15.10
Victoria	7.67	10.40	11.08	11.60	12.00	12.10	12.90	13.50	14.40	14.00	14.10
Australian Capital Authority	.10	.11	.13	.14	.16	.18	.20	.22	.24	.26	.28
C Total Depreciation	16.34	20.21	21.09	23.43	24.65	25.57	27.29	30.28	32.22	32.67	33.70
D Gross Income (A-B-C)	27.07	28.04	32.11	37.70	42.33	49.91	55.94	55.89	62.70	71.11	78.82
Average Net Fixed Assets in Operation											
Snowy Mountains Authority (power assets only)	112.50	124.00	151.20	166.00	163.00	160.30	205.50	251.20	248.40	265.80	283.30
New South Wales	132.40	135.30	141.30	155.00	169.10	180.90	197.50	211.40	226.50	235.20	245.50
Victoria	224.20	256.50	276.00	293.00	312.00	329.00	347.00	364.00	379.00	398.00	420.00
Australian Capital Territory	2.70	2.95	3.40	3.80	4.30	5.10	5.20	5.70	6.20	6.70	7.00
E Total	471.80	518.75	571.90	617.80	648.40	675.30	755.20	832.30	860.10	905.70	955.80
Return on Average Net Fixed Assets in Operation $(\frac{D}{E})$	5.7%	5.4%	5.6%	6.1%	6.5%	7.4%	7.4%	6.7%	7.3%	7.9%	8.2%

ANNEX 6

THE NEW SOUTH WALES ELECTRICITY COMMISSION

The Commission is a body corporate with perpetual succession and a common seal. It was established in May 1950 by the Electricity Commission Act of NSW to acquire and operate the major generating organizations then existing in the State, to integrate them into one system, and to increase power production and develop the State's resources, other than the hydro-electric resources in the Snowy Mountains area, to cater for its future electricity requirements.

The Commission sells in bulk to 42 distributing authorities, the NSW railways and 82 large industrial consumers. It does not operate any distribution systems. Its largest consumer, and the largest distributing authority is the Sydney County Council which accounted for 42% of total sales in the year 1960/61.

Since its establishment the Commission has acquired nearly all of the generating organizations in NSW and it now supplies over 97% of the State's public electricity requirements.

Sales of electricity by the Commission have increased from 1,121 million kwhs in 1951/52, the first full year of operation, to 7,700 million kwhs in 1960/61, and during the same period the system maximum demand has increased from 413 MW to 1,860 MW.

Capitalization

At the time of its creation, the New South Wales Electricity Commission took over all assets and liabilities of its predecessors, the capitalizations of which were all in the form of long-term debt. Since 1950, the Commission has obtained funds from two main sources: advances from the State Treasury and, to a lesser extent, borrowings raised on the local money market.

Balance Sheets of the Commission for the last 3 years are summarized below (in millions of £A):

As at June 30	1959	1960	1961 (estimated)
Assets			
Fixed assets in operation (at cost)	175.8	189.4	203.7
Depreciation reserve	44.4	54.5	66.4
Net fixed assets in operation	131.4	134.9	137.3
Work in progress	12.2	14.4	16.0
Current and other assets	34.4	41.3	52.7
Total Assets	178.0	190.6	206.0
Liabilities			
State Treasury advances	126.1	135.5	142.7
Other loans and bond issues	33.7	35.5	37.8
Total long-term debt	159.8	171.0	180.5
Special reserves	11.2	14.2	17.9
General reserves	2.1	2.6	3.5
Current and other liabilities	4.9	2.8	4.1
Total Liabilities	178.0	190.6	206.0

State Treasury advances have maturities of 15 to 25 years and carry interest rates based on the average interest which the State of New South Wales pays to the Commonwealth of Australia. Other loans and bond issues have relatively short maturities (7 to 12 years) and rates of interest ranging from 3-1/2% to 5-5/8%.

Rates and Financial Practices

The Electricity Commission enjoys a rather high degree of autonomy in rate making. In the absence of legal provisions as to how tariffs should be computed, the guiding principle has been that rates should be high enough to produce revenues covering all expenses, including interest, and proper allocations to reserves. It is left to the Commission to decide what reserves should be set aside.

In practice, the Commission has followed very conservative financial practices, particularly with regards to depreciation. It charges 20-year straightline depreciation on all fixed assets except for smaller plants which are written down even faster, in 10 years. Depreciation begins to accrue from the time expenditures are made rather than from the beginning of commercial operation. The Commission has thus been able to generate substantial funds for reinvestment, while keeping the apparent surplus at a rather low figure.

Recent Earnings

Income statements of the Comission for the last 3 years are summarized below (in millions of ₺A):

	1958/59	1959/60	(estimated) 1960/61
Operating revenues	44.58	47.65	51.50
Other income	.35	.51	.90
Total revenues	44.93	48.16	52.40
Operation and maintenance	27.81	28.83	30.69
Depreciation	9.60	11.72	13.00
Gross income	7.52	7.61	8.71
Interest	7.43	7.13	7.80
Net surplus	.09	.48	.91

The return on the Commission's fixed assets in operation increased from 5.7% in 1958 to 6.4% in 1960. If depreciation had been taken on a more normal 30-year straightline basis, the return figure for 1960 would be in the vicinity of 8 to 9%.

ANNEX 7

THE STATE ELECTRICITY COMMISSION OF VICTORIA

The Commission was established in 1918 by the Electricity Commissioners Act as a body corporate with perpetual succession and a common seal. It controls its own revenues and disbursements and may sue or be sued in its corporate name. It has two functions: the supply of electricity and the production of fuel.

Since it began operating in 1919, the Commission has expanded and coordinated the production and distribution of electricity on a state-wide basis. At the present time it generates nearly all of the electricity produced in Victoria and serves about 97% of the population through a supply network covering more than two-thirds of the populated area of the State. The development of the Commission's electricity system is based on the utilization for power generation of the State's extensive brown coal deposits in the Latrobe Valley in south-eastern Victoria and the development of hydro-electric resources in the north-eastern part of the State.

About 75% of the electricity generated by the Victoria Commission during 1959/60 was produced by thermal plants using brown coal, either in its raw state or in the form of briquettes. Brown coal production during the year was about 13.2 million tons. Of this total 9.6 million tons was used raw in the Commission's thermal plants and 3.6 million tons was used to make 0.97 million tons of briquettes. The Commission used 0.33 million tons of briquettes in its thermal plants and sold the balance of 0.64 million tons to industrial and household users.

Sales of electricity by the Commission during 1960/61 totalled 5,286 million kwhs, an increase of 7.8% over the previous year. Over the five years the average percentage increase per annum was 8.0%.

On June 30, 1961, the Commission had 712,421 retail consumers who accounted for 72% of total sales during 1960/61. It was also supplying 11 distributing authorities with a total of 194,217 retail consumers.

Capitalization

At the time of its creation, the State Electricity Commission of Victoria had an initial capitalization consisting entirely of Government advances. In 1933, the Commission was granted authority to borrow on the local market. From 1935 to 1951, it has endeavored to gain gradual independence from State funds by filling most of its financing needs in the market.

When market conditions in Australia became unfavorable in 1951, the Commission had to resort again to the State Treasury to supplement its own borrowings. Since then, conditions have not sufficiently recovered to allow a return to the earlier practice of relying exclusively on loans and bond issues. In the fiscal year 1960/61, the Commission raised about 75% of its requirements on the market and obtained the balance from the

State Treasury. The practice in Victoria is thus almost exactly opposite of that observed in New South Wales, where the bulk of funds required by the Electricity Commission is received in the form of State Treasury advances.

Balance sheets of the Commission for the last 3 years are summarized below (in millions of £A):

As at June 30	1959	1960	1961
Assets			
Fixed assets in operation	232.8	278.7	311.4
less: Depreciation reserve	36.6	43.8	52.4
Net fixed assets in operation	196.2	234.9	259.0
Work in progress	57.1	36.3	27.3
Current and other assets	20.1	23.3	28.6
Total Assets	273.4	294.5	314.9
Liabilities			
Bond issues and long-term loans	195.8	210.8	219.1
State Treasury advances	49.7	54.2	63.2
Total long-term debt	245.5	265.0	282.3
Reserves	9.3	9.7	9.9
Current and other liabilities	18.6	19.8	22.7
Total Liabilities	273.4	294.5	314.9

Bond issues and long-term loans have short maturities of 5 to 12 years, and interest rates varying from 3-1/2% to 5-3/4% per annum. State Treasury advances carry interest rates based on the interest paid by the State of Victoria to the Commonwealth, and have maturities of 15 to 25 years.

Rates and Financial Policies

As in the case of New South Wales, the State Electricity Commission of Victoria is to a large extent free to determine its own tariffs. No official definition of what rates are intended to cover has ever been established. Up to 1950, the generally accepted principle was a "no-profit-no-loss" rule, according to which tariffs were to produce revenues sufficient to cover all operating costs including depreciation. In 1951, the rising need for new construction funds and the difficulty of obtaining satisfactory financing on the private capital market induced the Commission to increase rates to generate funds in addition to depreciation accruals.

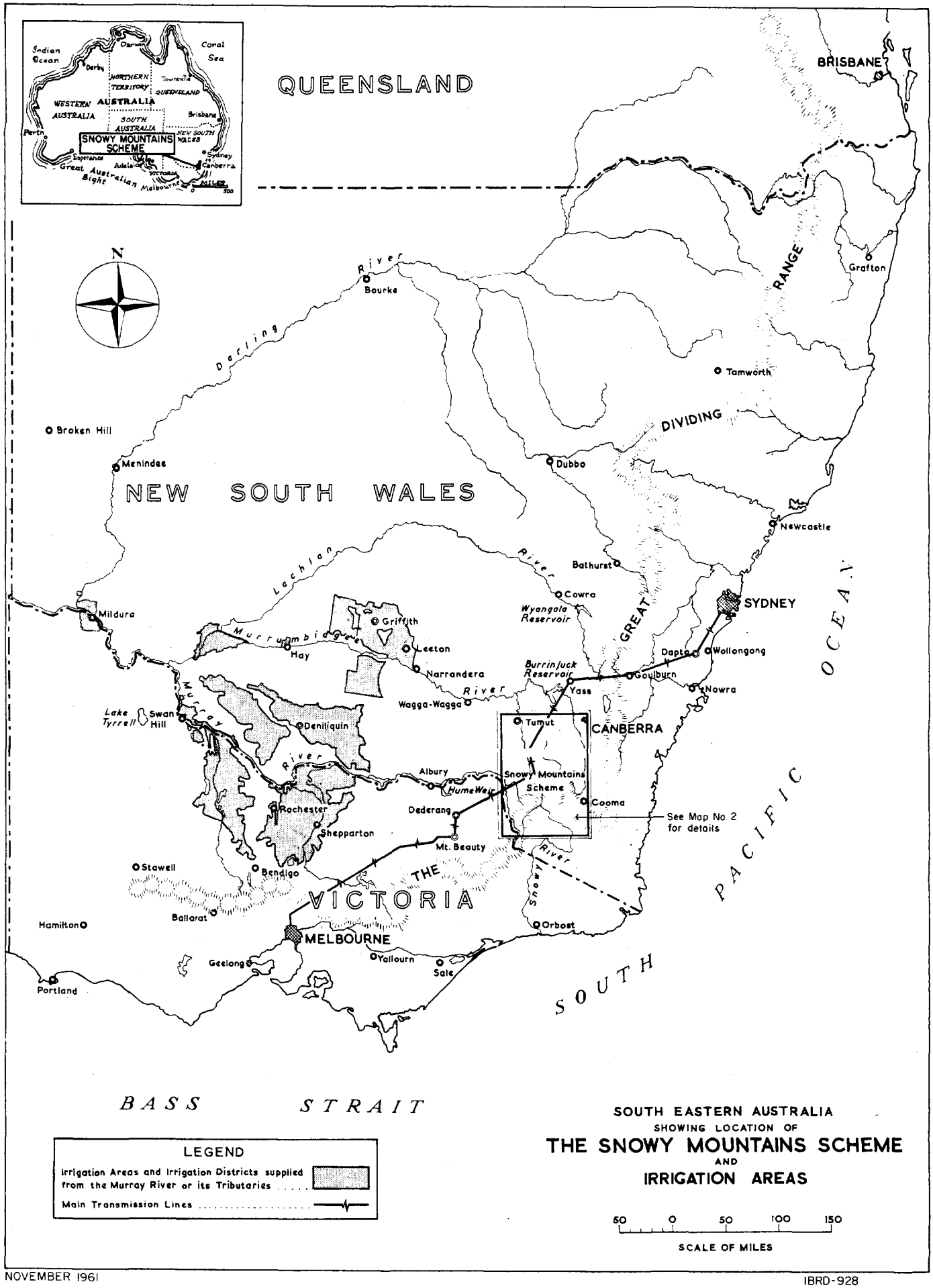
Rates were increased six times from 1951 to 1958. The most recent increase, averaging 8%, followed a shift from sinking-fund to straightline depreciation. The average life of about 32 years of the Commission's assets appears reasonable.

Recent Operating Results

Income statements of the Commission for the last 3 years are summarized below (in millions of LA):

	1958/59	1959/60	1960/61
Operating revenues	45.39	50.43	55.34
Operating expenses (including purchased power)	24.34	27.39	29.69
Depreciation	5.89	7.67	10.40
Gross income	15.16	15.37	15.25
Interest and financial charges	11.54	12.66	13.78
Net profit	3.62	2.71	1.47
Special write-off of suspense account	3.20	2.50	1.25
Transferred to reserves	.42	.21	.22

The return on the Commission's net investment in operation was about 5.9% in 1961. Because of heavy bond redemption payments due to the relatively short maturity of the debt, internal cash generation for expansion purposes has remained relatively modest at about 15 to 20% of new construction costs.



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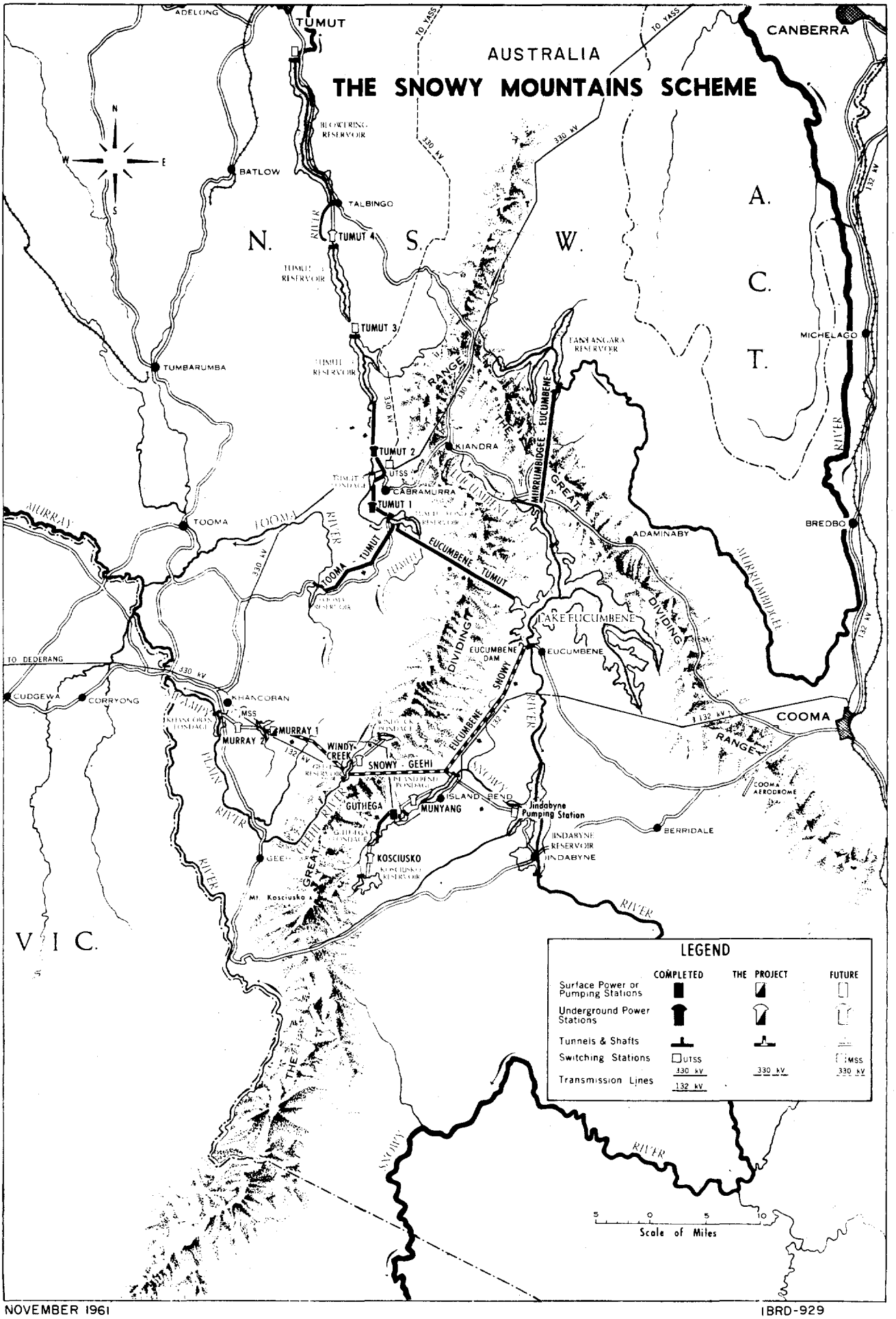

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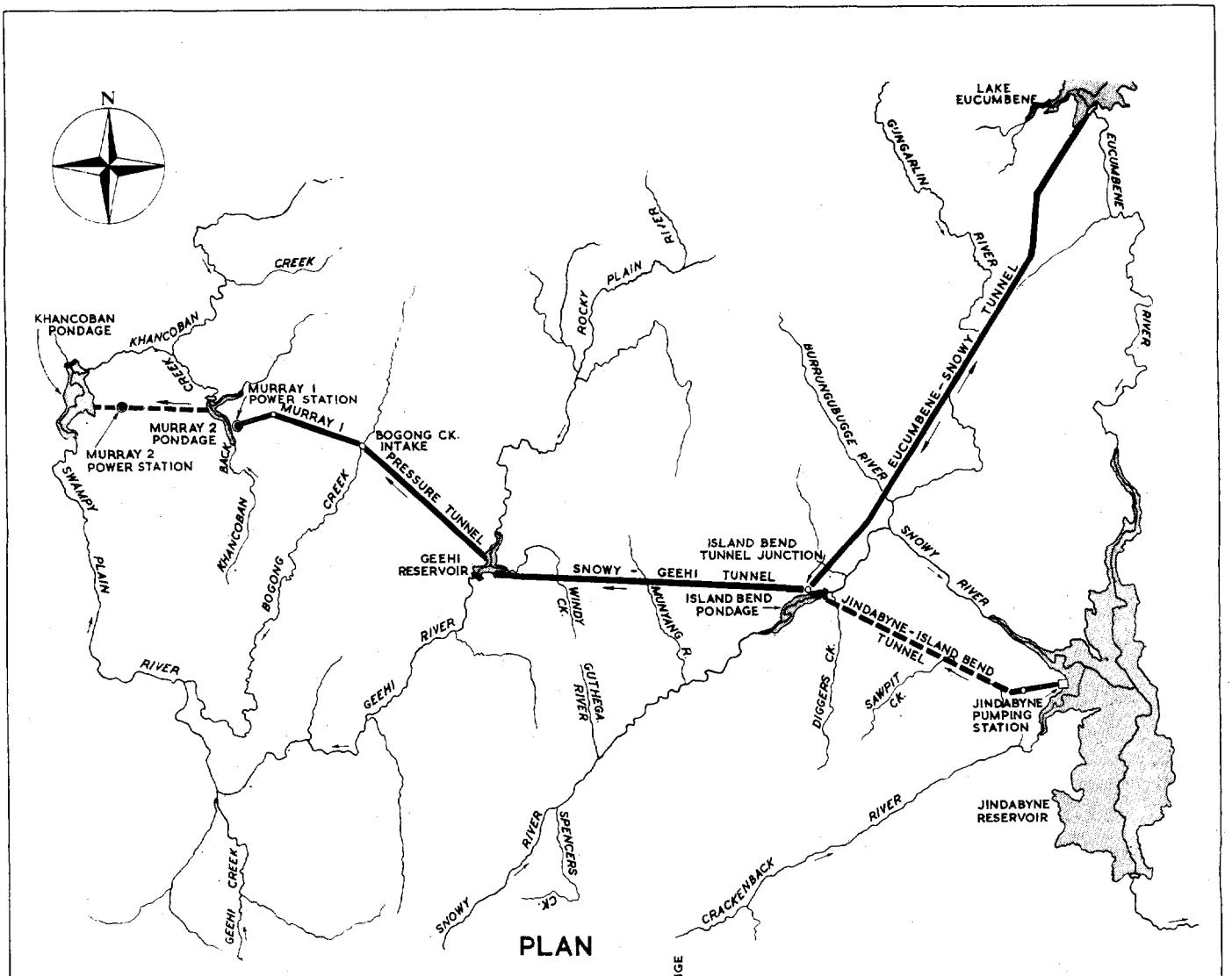

AUSTRALIA

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