1948

Victoria

REPORT

OF

STATE ELECTRICITY COMMISSION

OF VICTORIA

ON

EXTENSION OF

KIEWA HYDRO-ELECTRIC PROJECT

FROM 117 MEGAWATTS TO 289 MEGAWATTS

AND MATTERS RELATED TO THE SYSTEM GENERATING CAPACITY

Presented to both Houses of Parliament by His Excellency's Command

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STATE ELECTRICITY COMMISSION OF VICTORIA

REPORT

ON

EXTENSION OF KIEWA HYDRO-ELECTRIC PROJECT FROM 117 MEGAWATTS TO 289 MEGAWATTS AND MATTERS RELATED TO THE SYSTEM GENERATING CAPACITY

The Honourable J. H. Lienhop, M.L.C.,
Minister in Charge of Electrical Undertakings,
Treasury Gardens,
MELBOURNE, C.2.

Sir,

I. INTRODUCTION

1. The Commission's report to the Government, dated 12th June, 1937, as approved by Parliament in the State Electricity Commission (Extension of Undertaking) Act 1937, provided for a hydro-electric project on the Kiewa River of 117,000 kilowatts (i.e., 117 megawatts) capacity at an estimated cost of £6,504,500. The estimated cost was amended to £7,670,000 in 1941 because, in the interim, the basic wage had risen from £3/6/- per week to £4/7/- per week.

2. The 1937 Kiewa project, prior to its submission to the Government, was critically reviewed by Consulting Engineers, Messrs. Rendel, Palmer and Tritton, of London, in association with Messrs. Vattenbyggnadsbyran, of Stockholm, and, in their subsequent report, they indicated that an enlarged project might be possible after further detailed investigation of the water power resources of the terrain adjacent to the Bogong High Plains. This enlargement has proved practicable, and the Commission considers that full advantage should be taken of it.

3. In this report the Commission now submits proposals for expanding the project to one of 289 megawatts capacity, with an annual output, averaged over a typical period of wet and dry years, of about 986,000,000 kilowatt-hours. Achievement of this greater capacity and greater average output of electricity will require a considerable increase in the water storages at Pretty Valley and Rocky Valley, and the inclusion in the project of two additional power stations.

4. It is estimated that the total cost of the enlarged project, based on wages, conditions and prices as at October, 1947, but including, also, the effect of the 40-hour week to be introduced in January, 1948, will be £25,270,000, including £2,537,000 already spent on the 117 megawatts project to the 30th June, 1947. Given stability in Australian industrial conditions, and with no undue delays in deliveries of plant from overseas, the enlarged project could be completed by 1956.

(NOTE.—Electrical power is measured in kilowatts (kW), one kilowatt being equivalent to 1.34 horse-power; 1,000 kilowatts = 1 megawatt. Electrical energy is measured in kilowatt-hours (kWh), one kilowatt-hour being equivalent to a kilowatt of power supplied over a period of one hour.)

II. BASIC CONSIDERATIONS RELATING TO THE INTERCONNECTED GENERATING SYSTEM

5. The Commission's interconnected generating system as developed to date comprises two principal groups of power stations:—

(a) **Hydro Stations**

(i) Sugarloaf/Rubicon.

(ii) Kiewa.

(b) **Heat Stations**

(i) Yallourn Power Station burning raw brown coal.

(ii) Metropolitan and provincial stations burning briquettes.

6. In meeting the total system demand, which fluctuates throughout the day and from month to month throughout the year, each group of stations is assigned a predetermined function dependent upon the availability of power from each group and the overall economics of generation. The various stations are used in the combination that will most economically meet the system load at the time.

7. This results in a control of the Commission's interconnected generating system on the following general lines:—

(a) The Sugarloaf/Rubicon hydro stations are operated at all times in accordance with the natural water flow.

(b) The Kiewa hydro stations, which depend upon large water storages at Rocky Valley and Pretty Valley, will be so regulated from day to day as to effect the greatest possible saving of fuel in the heat stations, particularly those in the metropolitan and provincial areas burning briquettes.

(c) The Yallourn Power Station, because of the very low cost and ample supply of available raw brown coal, is a base load station, and is operated continuously at its economic maximum capacity.

(d) The metropolitan and provincial heat stations (Newport, Richmond, Spencer Street (City of Melbourne), Geelong and Ballarat) which are situated close to load centres, are peak load stations designed to assist in meeting the heavy short-period demand and to provide reserve generating capacity at minimum cost.

III. ANTICIPATED INCREASE IN DEMAND FOR ELECTRICITY TO 1956

8. In the last 20 years the maximum coincident demand on the power stations which now comprise the interconnected State generating system has increased about fourfold; in the same period the output of electricity from the system has increased about sixfold. The rate of increase has not been uniform; it has been influenced by fluctuations in general industrial activity brought about by such conditions as the economic recession of 1930-34 and the world war of 1939-45. The growth of demand since 1937 is shown in the chart of system loading and plant capacity (Plate No. 1) attached.

9. In forecasting likely future requirements, the Commission has considerable statistical material on which to base its conclusions, but estimates in respect of a long period ahead merely depict a general trend and necessarily cannot apply with accuracy to any particular year. Such estimates need to be kept under continuous review, and adjusted from time to time according to circumstances.

10. With due regard to the limitations described in paragraph 9, particularly as related to the existing uncertainty of world economic affairs inseparable from post-war conditions, the following table shows the marked upward trend anticipated in electricity requirements up to 1956:—

STATE GENERATING SYSTEM
UPWARD TREND OF ELECTRICITY REQUIREMENTS TO 1956

Year	Demand (kW)	Output (kWh)
		(millions)
1948	457,000	1,958
1949	484,000	2,125
1950	517,000	2,295
1951	550,000	2,474
1952	584,000	2,659
1953	621,000	2,851
1954	660,000	3,049
1955	701,000	3,255
1956	745,000	3.467

IV. THE KIEWA DEVELOPMENT COMPARED WITH ALTERNATIVE SOURCES OF POWER

11. In 1937 the Kiewa project of 117 megawatts was shown to be economically superior to any alternative power generation scheme. A similar economic examination has been made in relation to the 289 megawatts Kiewa project, and it has been estimated that the annual operating cost of this larger project would be £750,000 less than for any alternative power generation scheme.

12. In view of this very substantial saving in favour of the Kiewa development, it is unnecessary to stress the evident advantage in continuing construction at Kiewa beyond the 117 megawatts stage while there is a construction organisation established in the area with all its personnel and material resources.

V. PLANNED INSTALLATIONS AT KIEWA AND ELSEWHERE TO MEET THE ANTICIPATED SYSTEM DEMAND

13. In addition to this major Kiewa development the Commission has made provision for the installation of additional steam plant at Yallourn and Newport. It is expected that hydro-electric plant at the Hume Weir will be available by 1952. Further, under the Morwell project for increased briquette production, as outlined

in the Commission's report to the Government of the 13th December, 1946, electricity will be available as a by-product of the briquetting process. No allowance has been made for the Snowy River proposals now under Commonwealth and State examination, although progress in the development of that project may provide additional generating capacity late in the next decade; and no account has been taken, either, of the possible increase in production from the Sugarloaf Power Station, arising from the proposed enlargement of the Eildon reservoir by the State Rivers and Water Supply Commission.

14. The planned installations up to 1956 and their relation to the expected maximum coincident demand are set out in the following table and are shown graphically in the chart of system loading and plant capacity attached (Plate No. 1).

VICTORIAN INTERCONNECTED GENERATING SYSTEM

PLANNED INSTALLATIONS

(Additional to Existing Plant and Excluding Replacements)

Year	Installations							Total Installed capacity of the system	Estimated maximum coincident demand
	Yallourn	Briquette factories (Morwell)	Newport	Spencer Street, Melbourne	Kiewa	Hume	Total		
	kW	kW	kW	kW	kW	kW	kW	kW	kW
1948	—	—	30,000	—	—	—	30,000	457,000	457,000
1949	—	—	30,000	5,000	—	—	35,000	492,000	484,000
1950	—	—	15,000	—	—	—	15,000	507,000	517,000
1951	50,000	—	—	—	45,000	—	95,000	602,000	550,000
1952	—	—	—	—	32,000	21,000	53,000	655,000	584,000
1953	—	20,000	—	—	75,000	—	95,000	750,000	621,000
1954	25,000	—	—	—	—	—	25,000	775,000	660,000
1955	50,000	—	—	—	13,000	—	63,000	838,000	701,000
1956	—	20,000	—	—	98,000	—	118,000	956,000	745,000
Totals	125,000	40,000	75,000	5,000	263,000	21,000	529,000	—	—

15. The above table shows that in 1948 there will be no margin of installed plant capacity compared with the estimated maximum coincident demand. In 1949 there will be only a small margin of capacity over demand, and in 1950 there will be a slight deficiency; this deficiency, however, is so small as not, in itself, to constitute any threat to continuity of supply. From 1951 onwards the margin will become more favourable.

VI. THE FUTURE FUEL REQUIREMENTS OF THE STATE GENERATING SYSTEM

16. The heat stations at Newport, Richmond, Spencer Street (City of Melbourne), Geelong and Ballarat use briquettes, and it is essential that adequate supplies of this fuel (or, alternatively, of New South Wales black coal) should be available. The

estimated briquette requirements for these stations during the next few years are shown in the following table:—

ESTIMATED BRIQUETTE REQUIREMENTS FOR THE HEAT STATIONS

(Newport, Richmond, Spencer Street (Melbourne), Geelong and Ballarat)

Year	Estimated Briquette Requirements Tons
1948	502,000
1949	624,000
1950	748,000
1951	664,000
1952	556,000
1953	466,000
1954	466,000
1955	466,000

17. As stated in paragraph 15 there is no real threat to the future continuity of electricity supply for lack of installed plant. It is expected that any call for load reduction to correspond to plant capacity will involve relatively minor economies on the part of consumers, particularly as the maximum demand occurs on only one day in each year and is approached on only about six other days when there is a combination of low temperature and poor light, and its duration is generally less than one hour. But there is still a grave risk that sufficient solid fuel will not be available for the Commission's briquette-burning stations. Shortage of fuel was the sole cause of electricity rationing on the Victorian system in the winter of 1946. In the winter of 1947 the serious effect of the general shortage of fuel was obscured by the long industrial dispute affecting all metal trades employees in the State; this delayed the installation of new plant and prevented the proper maintenance of existing plant. If the Commission is placed under the necessity of re-imposing restrictions on this scale in 1948 and later years, this will be the direct result of its inability, because of Commonwealth coal control, to retain for power generation the whole output of the Yallourn Briquette Factory and to secure the balance of its fuel requirements from New South Wales. For example, in 1950 there would be required, in addition to the whole of the factory output, more than 100,000 tons of New South Wales black coal to meet full Commission requirements.

18. The decrease in the estimated requirements of the briquette-burning stations from 1951 onwards reflects the increasing use of hydro-power from that year, as well as the planned increased production at the extended Yallourn Power Station, which uses raw brown coal.

19. From 1955 onwards, the quantities of briquettes required for power generation will steadily increase. The output of the Yallourn Briquette Factory will then again become insufficient to meet the needs of electricity generation, and, although the increased briquette production planned at Morwell is primarily for general industrial use, a portion of that increased production will be required for Commission power stations to ensure that the generation of electricity is independent of imported fuel.

20. The recent Royal Commission on Electricity Supply, in recognising the inevitability of a continued shortage of fuel in Victoria during the next few years, recommended that the Government and the State Electricity Commission treat as urgent the procuring of increased supplies, both of New South Wales black coal and of Victorian brown coal. The Commission, having every reason for being aware of

the seriousness of this position, will continue to urge upon the responsible authorities the need for additional fuel in order that rationing of electricity will not again be imposed upon its consumers for this reason.

VII. PROGRESS OF THE 117 MEGAWATTS KIEWA PROJECT

21. The Kiewa project, as planned in 1937, comprised four power stations utilising waters from the West Kiewa and East Kiewa Rivers, as shown in the following table:—

INSTALLED CAPACITY OF POWER STATIONS

Power Station	Installed Capacity kW
No. 1	21,000
No. 2	33,000
No. 3	24,000
No. 4	39,000
Total	117,000 kW

22. Basic to the Kiewa project was the construction of two main water storages in Pretty Valley (95,000 acre feet) and in Rocky Valley (13,000 acre feet), together with other smaller storages for regulating purposes.

23. This project was originally scheduled for completion by 1951, but the construction programme has been greatly retarded by the shortage of labour and materials during and since the war. Nevertheless, the No. 3 Power Station was completed during the war and was put into service in September, 1944. Work on the No. 4 Power Station is proceeding, and the plant at this station is scheduled to operate by the winter of 1951.

24. The Commission has established a small township at Bogong for the accommodation of staff and construction employees. At Mt. Beauty a larger construction township is in course of development. This will include engineering stores and workshops as well as residential quarters and general community amenities.

VIII. DESCRIPTION OF THE 289 MEGAWATTS KIEWA PROJECT DEVELOPMENT

25. The investigations carried out subsequent to the 1937 report have revealed that the water resources available to the Kiewa development can be augmented, as follows:—

(a) An additional 30 square miles of catchment, of which two-thirds is outside the Kiewa catchment, can be used to feed the Pretty Valley and Rocky Valley reservoirs. This will increase the catchment for these storages to a total of 47 square miles.

(b) Water from about 40 square miles of the Big River catchment (i.e., the head waters of the Mitta Mitta) can be brought into the scheme at a point just above No. 2 Power Station and used through a total head of 2,500 feet.

(c) Water from some areas within the Kiewa catchment can be used at higher heads than was previously contemplated.

26. It is estimated that the additional water resources will be sufficient to permit the electrical output to be increased from 440 million kilowatt-hours per annum, as provided in 1937, to an average of 986 million kilowatt-hours per annum, as now intended. For the enlarged project the generating plant, including two additional stations, will be as follows:—

KIEWA—INSTALLED PLANT CAPACITIES

Power Station	1937 Project kW	Enlarged Project kW
No. 1	21,000	60,000
No. 2	33,000	98,000
No. 3	24,000	26,000
No. 4	39,000	60,000
No. 5	—	32,000
"P" *	—	13,000
Total	117,000	289,000

(* Note.—Station "P" will contain reversible turbine units which can be used either for pumping or for generating electricity, depending on requirements (see paragraph 29).)

27. The Pretty Valley storage will be increased from 95,000 acre feet, as planned for the 1937 project, to 160,000 acre feet. The dam will be of the multiple-arch reinforced concrete type and will be about 200 feet above the stream bed instead of 124 feet as previously designed. The Rocky Valley storage will be increased from 13,000 acre feet to 22,000 acre feet, and the dam will be of the earth and rock-fill type. The height of this dam will be about 100 feet above the stream bed.

28. A further important feature of the project is the system of underground tunnels which will be driven through solid rock. In addition to the tunnel to No. 3 Station already constructed, there will be required about 88,000 feet (17 miles) of tunnelling, the largest being over 300 square feet in sectional area.

29. A brief description of the layout of the civil works of the proposed revised scheme, which should be read in conjunction with Plates Nos. 2 and 3 attached, is as follows:—

(a) The Pretty Valley reservoir will store water from its natural catchment and also additional water pumped from Rocky Valley reservoir through Station "P". About one-half of the capacity of Pretty Valley reservoir will constitute a reserve storage to be drawn upon only in drought periods.

(b) Rocky Valley reservoir will receive water from its natural catchment and also water intercepted from portion of the Big River catchment by means of open race lines. Water from Rocky Valley reservoir will flow by tunnel to No. 1 Power Station (60,000 kW); the station will be placed underground, and will be operated at an average net head of 1,442 feet.

(c) Water from Pretty Valley reservoir will flow first by pipe line to Station "P" (now acting as a generating station—13,000 kW), and thence by tunnel, connecting with the tunnel from Rocky Valley, to No. 1 Power Station. Turbo-generators in Station "P" will generate energy by utilising the head of 250 to 300 feet corresponding to the varying difference in level of water in Pretty Valley and Rocky Valley reservoirs.

(d) Water passed through No. 1 Power Station will flow by open race line and tunnel to Howman Dam, which will form a regulating pondage for No. 2 power Station. Additional water from the zone of catchment between the storage reservoirs and elevation 3,800 feet will also be led to this pondage by open race and by natural drainage. From the pondage a further tunnel will carry the water to No. 2 Power Station and will be joined near the station by the tunnel bringing water from the 40 square miles of Big River catchment. No. 2 Power Station (98,000 kW) will be the largest in the scheme and will be placed underground. The net operating head will be, on the average, 1,530 feet.

(e) From this station the water will be discharged by a tunnel to the pondage at Lake Guy (already completed) and thence by tunnel to the existing No. 3 Power Station (26,000 kW) above ground (average net head, 341 feet).

(f) Water from No. 3 Power Station will discharge to the East Kiewa River and then be diverted by tunnel to No. 4 Station (60,000 kW), which will utilise the final 611 feet of net head. This station will be below ground level and will discharge by a tail race tunnel to an equalising pondage at the head of the Tawonga Flats.

(g) No. 5 Power Station (32,000 kW) will be underground and will make use of the water from the West Kiewa catchment, which will be brought by open races to a small pondage giving a net head of 1,565 feet at the turbines. From No. 5 Station the water will be discharged to No. 4 head race tunnel, where it will join the water from No. 3 Station.

(h) Thus water from Rocky Valley reservoir will pass in succession through Power Stations Nos. 1, 2, 3 and 4, and that from Pretty Valley through Station "P" as well, acting through a total net head of about 4,200 feet. Each power station will have its own pondage for day-to-day regulation of water flow, which will give added flexibility in operation.

30. The more important variations in the civil works required for the extended project, as compared with the 1937 plan, are as follows:—

(a) enlargement of the storages at Rocky Valley and Pretty Valley;

(b) provision of additional race lines, tunnels, pondages and ancillary works for diversion of waters from the Big River catchment;

(c) increase in installed capacity of all power stations other than No. 3;

(d) addition of No. 5 and "P" Power Stations with associated works;

(e) alteration of the location of No. 2 Power Station and the placing of both it and No. 1 Station underground;

(f) collection of the waters of the West Kiewa River by race line and their use in No. 5 Power Station instead of diversion of these waters by a tunnel to No. 3 Station.

31. Electricity will be generated at 11,000 volts at all power stations and led to the Mt. Beauty Switchyard, from which a double circuit steel tower transmission line operating at 220,000 volts will convey the energy about 158 miles to the metropolitan area. At the Mt. Beauty Switchyard provision will be made for connection with the projected Hume Power Station, and also for a power outlet to the North-Eastern District. In the metropolitan area extensive additions will be required to the Thomastown and Brunswick Terminal Stations, and a new terminal station will be constructed in the Eastern Suburbs. A diagrammatic representation of the electrical layout is shown in Plate No. 4 attached.

32. The main transmission pressure of 220,000 volts is considerably higher than any used on the Commission's system at present (the Yallourn-Melbourne line operates at 132,000 volts), and is higher than that proposed in the 1937 project

(165,000 volts). The higher voltage is in keeping with the much greater amount of energy to be transmitted, and is in conformity with modern overseas practice.

33. In the construction and operation of the whole Kiewa project the Commission attaches much importance to the preservation of the catchment from erosion, bush fires and other destructive influences, and it has taken appropriate initial measures to that end. The Commission recognises, however, that it will be necessary, in conjunction with other responsible Governmental authorities, to establish a long-range plan of management for the forested area, and it already has sought the co-operation of the Forests Commission in this important matter.

34. A tentative construction programme is tabulated hereunder. Adherence to this programme is dependent on a number of factors, such as availability of labour, plant and materials, which are outside Commission control.

TENTATIVE CONSTRUCTION PROGRAMME

Item	Date of Completion	Total Installed Capacity MW (progressive)
Bogong Creek Race to No. 3 Power Station	1948	26
No. 4 Development (three generators) ..	1951	71
Main Transmission Line, 1st circuit with transmitting and terminal stations ..	1951	
Pretty Valley Reservoir; storing of water to commence	1952	
Rocky Valley Dam	1952	
Races from Southern Catchments and Upper Big River	1952	
No. 5 Development	1952	103
No. 4 Development (4th generator)	1953	178
No. 1 Development		
Transmission Line; 2nd circuit	1953	
Higher Fainter Race Line	1954	
Station "P"	1955	191
Pretty Valley Dam and auxiliary dykes ..	1955	
Lower Big River diversion	1955	
No. 2 Development	1956	289

IX. VIEWS OF THE RIVER MURRAY COMMISSION AND OF THE VICTORIAN STATE RIVERS AND WATER SUPPLY COMMISSION

35. The Commission has informed the River Murray Commission and the Victorian State Rivers and Water Supply Commission of its proposals for extending the Kiewa project, and both these authorities have stated that the project would not adversely affect the flow of water for irrigation and other purposes.

36. The River Murray Commission has no objection to the project provided that the method of operation, as now intended, is not changed to the serious disadvantage of irrigation interests, except in circumstances of emergency outside the Electricity

Commission's control. The Electricity Commission sees no likely need for a change in the intended operational policy and would certainly confer with the River Murray Commission before making any radical departure from it.

37. The Victorian State Rivers and Water Supply Commission states that the benefits which would be conferred by the project over extended periods would far outweigh the small detrimental effect which might result at certain times by diversion of water from the Mitta to the Kiewa Valleys. The general system of water regulation proposed is satisfactory to the State Rivers and Water Supply Commission, and if occasions arise when it might be possible for assistance to be given to water supply interest, without detriment to power interests, by varying the release of water from the Kiewa storages, the Electricity Commission will extend its utmost co-operation.

X. VIEWS OF THE ROYAL COMMISSION ON THE ANTICIPATED INCREASE IN FUTURE DEMAND FOR ELECTRICITY AND THE PROPOSED PLANT ADDITIONS TO MEET THAT DEMAND

38. In the Appendix to this report, the Commission makes reference to the views of the Royal Commission on Electricity Supply regarding the anticipated increase in future demand for electricity and the proposed plant installations to meet that demand.

XI. CONSULTATION WITH OVERSEAS ENGINEERS

39. The Consulting Engineers to the 1937 Kiewa project, Messrs, Rendel, Palmer and Tritton, of London, in association with Messrs. Vattenbyggnadsbryan, of Stockholm, were in agreement with the methods used and conclusions drawn by the Commission's staff in regard to the fundamental hydrological data. They advised that the general layout of the proposed 1937 project was well conceived and suitably adapted to the general topography of the country.

40. As mentioned in paragraph 2 of the report, the Consulting Engineers were of opinion that further investigations might reveal the possibility of utilising additional water power resources of the Kiewa area. These investigations have been pursued during the intervening ten years and the enlarged scheme has been developed on lines substantially similar to those employed for the 1937 scheme, and the planning has been directed by the same senior engineering staff.

41. The Commission has had the advice of Dr. J. L. Savage, the eminent American engineer, in the design of the Pretty Valley Dam. After a visit to Kiewa in January, 1942, and discussions with the Commission's staff, Dr. Savage submitted a comprehensive report on the proposed dam in March, 1942. Further consultations with Dr. Savage were held in Melbourne in September, 1946, and the design of the dam as now proposed has been accepted by this expert.

42. The Commission will continue to take advantage of overseas collaboration and if necessary will send its specialist officers abroad as the construction programme develops. Already this year two members of its staff, Mr. E. L. Merigan, B.E.E.,

Electrical Engineer, and Mr. L. H. Lorimer, B.E.E., A.M.I.E.(Aust.), Assistant Engineer, Civil Branch, have visited America, and Mr. Merigan also Great Britain, to study modern developments in high voltage transmission, with particular reference to the Kiewa-Melbourne main transmission line.

XI. FINANCIAL

43. The estimated capital cost of the 289 megawatts Kiewa project, based on wages, conditions and prices as at October, 1947, but including also the effect of the 40-hour week to be introduced in January, 1948, is as follows:—

ESTIMATED CAPITAL COST

	£
Pretty Valley Dam and dykes ..	3,770,000
Rocky Valley Dam and intake ..	921,000
"P" Development	379,000
No. 1 Development	3,174,000
No. 2 Development	4,173,000
No. 3 Development	1,026,000
No. 4 Development	1,972,000
No. 5 Development	1,672,000
Kiewa Power Stations and Mt. Beauty Switchyard	2,111,000
Metropolitan terminals and interconnecting switchyards	2,610,000
Transmission (Kiewa-Melbourne) .	3,082,000
Supervisory control	227,000
Main roads; land	153,000
Total Capital Cost	£25,270,000

44. Of the above total capital cost, £2,537,000 had been expended as part of the approved 117 megawatts scheme to the 30th June, 1947. (If Kiewa were to be carried no further than the 117 megawatts capacity, the total cost, based on wages, conditions and prices as at January, 1947, is estimated at £10,646,000, including the amount already expended.)

45. The estimated annual operating charges, based on the same factors noted in paragraph 43, are as follows:—

ESTIMATED ANNUAL OPERATING CHARGES

	£
Interest (4%)	1,010,800
Depreciation	361,484
Operation, maintenance and other special charges	218,816
Total Annual Operating Charges	£1,591,100

46. It is expected that the capital expenditure will be spread over the total construction period, as shown in the following table:—

PROGRESSIVE CAPITAL EXPENDITURE

Period	Expenditure
	£
To 30th June, 1947	2,537,000
1947/48 to 1949/50	6,926,000
1950/51 to 1952/53	10,340,000
1953/54 to 1955/56	5,467,000
Total	£25,270,000

47. In the Commission's report of 13th December, 1946, on the Further Development of the Briquette Industry Based on the Brown Coal Resources in the Latrobe Valley, it was stated that the borrowing limit of the Commission would need to be increased. For the Kiewa works programme the limit should be further increased by £22,500,000.

XIII. LEGISLATIVE REQUIREMENTS

48. The State Electricity Commission (Extension of Undertaking) Act 1937, declared the Kiewa Scheme in the form in which it was described in the Commission's 1937 Report as having been approved by the Governor-in-Council pursuant to the State Electricity Commission Acts. The extension to 289 megawatts, as proposed in this report is a variation of such magnitude, involving such a large capital expenditure and is so importantly related to the interests of other public authorities, that, in addition to the borrowing provisions, specific Parliamentary endorsement of the enlarged project should be obtained.

XIV. RECOMMENDATIONS

49. It is recommended that the State Electricity Commission be authorised to enlarge the generating capacity of the Kiewa Hydro-Electric project from 117 megawatts, as provided for in the Commission's 1937 Report, to 289 megawatts, by additions and modifications, as described herein. The major reasons for recommending this project are as follows:—

(a) It is soundly based on proper investigation and full data.

(b) It is economically sound and urgently required.

(c) It is an essential part of the Commission's plan to increase the generating capacity of the main interconnected system of power stations.

(d) It will save solid fuel.

(e) It will still further disperse the State's generating stations.

50. It is recommended, also, that authority for increased borrowing powers be given to the Commission, as referred to in paragraph 47 of this report, and that legislation be enacted for adoption by the State of this enlarged Kiewa Hydro-Electric project.

XV. COMMENDATION

51. The hydrological investigations, on which the Kiewa extension is based, covered a period of about 10 years. They were in continuation of similar investigations which Commission engineers had been pursuing for nearly 15 years prior to the 1937 Report. These investigations have been faithfully carried out over the years in mountainous country and under unfavourable climatic conditions. The examination of this hydrological data and the subsequent preparation of designs and estimates for the extended project represents a work of considerable magnitude and complexity, which the Commission considers has been accomplished by its engineering staff with thoroughness and conspicuous ability. The engineering investigations related to this enlarged project were undertaken by the Commission's Design and Construction Department, functioning under the general direction of Mr. E. Bate, M.C., B.Sc., Whit.Sch., A.M.I.E.(Aust.), the Chief Engineer of the Commission, upon whose recommendations this report is founded.

We have the honour to be, Sir.

Your obedient servants,

G. G. JOBBINS, Chairman
ANDREW W. FAIRLEY, Commissioner
W. D. CHAPMAN, Commissioner
A. W. HENDERSON, Commissioner.

W. J. PRICE, Secretary.
21st November, 1947.

APPENDIX

VIEWS OF THE ROYAL COMMISSION ON THE ANTICIPATED INCREASE IN FUTURE DEMAND FOR ELECTRICITY AND THE PROPOSED PLANT ADDITIONS TO MEET THAT DEMAND

(a) The Anticipated Increase in Future Demand for Electricity

1. In its report of the 29th August, 1947, the Royal Commission takes the view that the Electricity Commission is under-estimating post-war requirements and that it should plan for growth at a rate of 8 per cent. per annum, on the assumption that this was the actual rate of growth before and during the war period.

2. In the course of Commission evidence to the Royal Commission it was stressed that, if in the graph of maximum demands a line were drawn through the points showing the demands for 1942, 1943 and 1944, the rate of increase per annum during that period was very much less than 8 per cent. In fact it was of the order of 5 per cent. It was not until after the second half of 1945—a year which marked the world's entry into the post-war period—that there was a sudden increase in the winter maximum demand to 377,000 kW, an increase of nearly 12 per cent. on the winter demand of 1944. If world events and the uncertainties of that time are borne in mind, it is evident that an increase of such magnitude could not reasonably have been foreseen, and in the opinion of the Commission it was so abnormal that it should not be taken as an indication of the probable sustained rate of the growth of electricity demand in the future.

3. In the face of experience in 1942, 1943 and 1944, the estimate made in 1944 was an appropriate estimate in the light of the facts then known, and on the basis of this estimate the Commission would have had a growing reserve of plant. Nowadays time-delay between ordering and commissioning plant is at least four years. Therefore, even if subsequent events had been more optimistically predicted and a related increased estimate had been adopted in 1944, any action taken—if possible—to order additional plant from abroad would not have ensured the availability of such plant until about 1949.

4. The Royal Commission has agreed that the steps taken by the Commission to acquire additional plant during the war period were, in the light of all circumstances, appropriate. The discussion of the appropriateness of estimates, therefore, can be centred rather on their relation to the task of providing adequate plant for the period from about 1949-50 onwards—that is, for the period covered by this Kiewa report.

5. Efforts now must rather be directed to obtaining and installing as much generating plant as is possible, and as soon as possible, and only when an adequate reserve of plant will have been re-established does the estimated rate of growth in future years become of prime importance.

(b) The Proposed Plant Additions to Meet the Anticipated Demand

6. As shown in paragraph 14 of this Kiewa Report, there is a margin of installed plant capacity compared with estimated maximum coincident demand in 1949 and from 1951 onwards, although not to the extent of a 25 per cent. reserve with a minimum of 15 per cent. as recommended by the recent Royal Commission on Electricity Supply. This margin appears to the Electricity Commission to be excessive and not to take into account the characteristics of the Commission's interconnected system or its tie with the Power Station of the Victorian Railways at Newport.

7. On a system such as the Commission's, with its several generating stations and very reliable interconnections, and having a load which admits of the overhaul of plant during the lower loading period after the winter demand, 20 per cent. of reserve plant is considered ample. It is the Commission's intention to restore the reserve to about this figure as soon as possible. The Electricity Commission bases this margin on the anticipated maximum coincident demand and not on the total installed plant capacity of its several power stations.

8. Acceptance of an 8 per cent. annual increase of load, as suggested by the Royal Commission, together with the requirement that a 25 per cent. reserve be achieved in, say, five years, would mean that the rate of addition of generating plant to the existing system would be over 60,000 kW per annum, which would involve a capital expenditure on generating plant and associated works of not less than £6,000,000 per annum. In the face of present difficulties with regard to material and labour, both overseas and in Australia, this rate of plant increment cannot be achieved even if it were desirable.

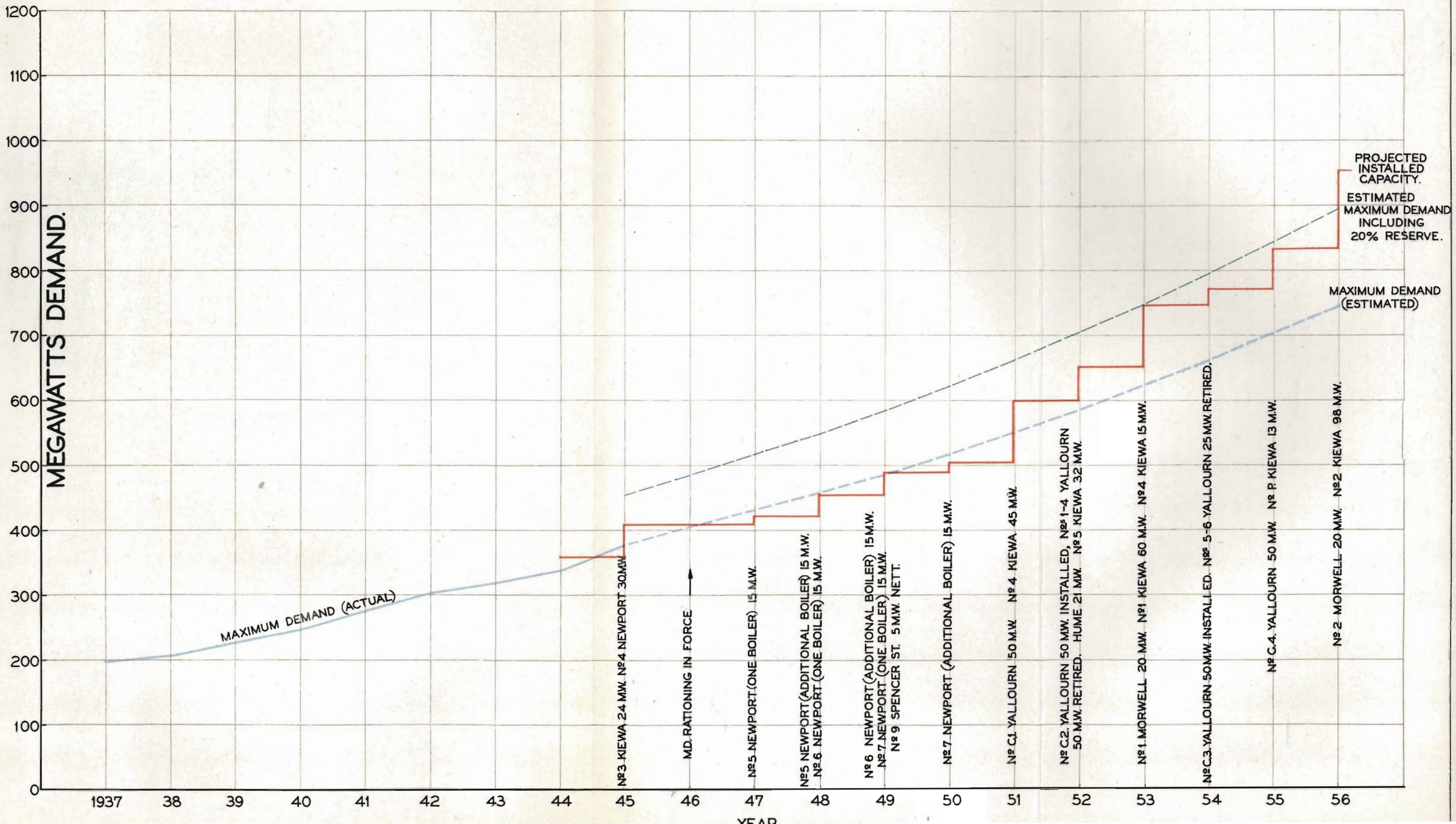
9. The Royal Commission further recommended that the installation of generator sets C.3 and C.4, Yallourn (each 50,000 kW), be proceeded with as expeditiously as possible. It was disclosed in evidence that C.3 generator, together with the associated boiler plant and auxiliaries, is planned to come into operation in 1954, and C.4 in 1955, and this seems a reasonable and even slightly optimistic anticipation of progress.

10. In any event, allowance has been made in the table mentioned in paragraph 14 of this Kiewa Report for the retirement of Nos. 1 to 4 machines at Yallourn, totalling 50,000 kW, in 1952, and Nos. 5 and 6 machines, totalling 25,000 kW, in 1954. If, as is likely, these machines can be retained and made available for winter loading, they will appreciably fortify the generating system and augment the reserve of generating plant.

STATE ELECTRICITY COMMISSION OF VICTORIA.

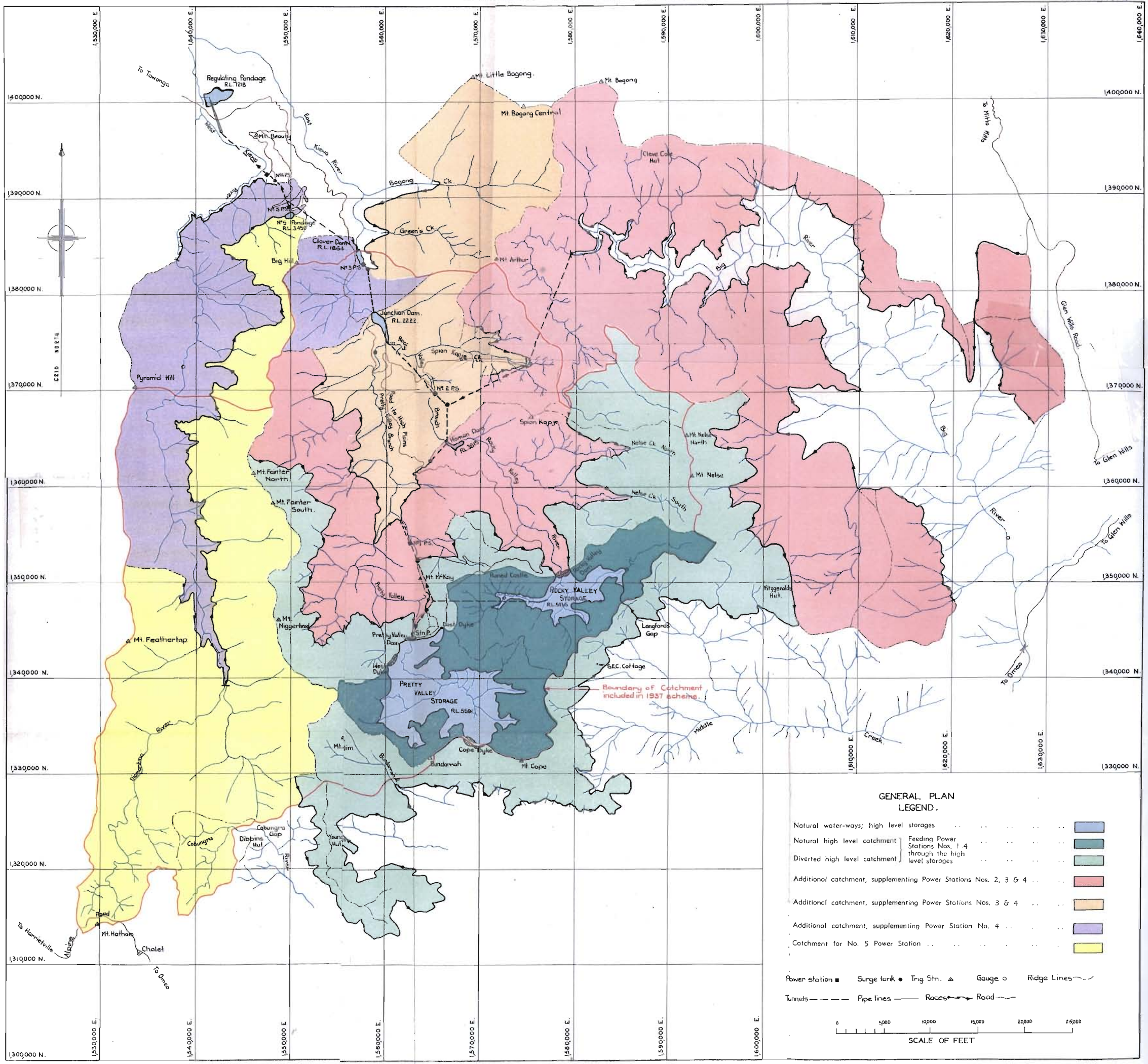
PLATE Nº 1.

SYSTEM LOADING AND GENERATOR CAPACITY.



GENERAL PLAN
ENLARGED KIEWA PROJECT

PLATE No. 2



GENERAL PLAN
LEGEND.

- Natural water-ways; high level storages
- Natural high level catchment } Feeding Power Stations Nos. 1-4 through the high level storages
- Diverted high level catchment } Feeding Power Stations Nos. 1-4 through the high level storages
- Additional catchment, supplementing Power Stations Nos. 2, 3 & 4
- Additional catchment, supplementing Power Stations Nos. 3 & 4
- Additional catchment, supplementing Power Station No. 4
- Catchment for No. 5 Power Station

Power station ■ Surge tank ● Trig. Stn. △ Gauge ○ Ridge Lines

Tunnels — — — Pipe lines ——— Races ⟿ Road ~~~

0 5,000 10,000 15,000 20,000 25,000

SCALE OF FEET

KIEWA HYDRO ELECTRIC PROJECT

NORTH EASTERN VICTORIA • AUSTRALIA • INSTALLED CAPACITY 289,000 KW

STATE ELECTRICITY COMMISSION OF VICTORIA

MT. HOTHAM 6100 FEET

MOUNT COPE

MT. LOCH

MT. MO KAY

MT. FAINTER

MT. FEATHERTOP

PRETTY VALLEY DAM

PRETTY VALLEY BRANCH

ROCK VALLEY BRANCH

MT. NELSE

SPION KOPJE

BIG RIVER VALLEY

MT. BOGONG 6508 FEET

HOWMAN DAM

JUNCTION DAM

LAKE GUY

CLOVER DAM

EAST KIEWA RIVER

WEST KIEWA RIVER

NO 5 PONDAGE

REGULATING PONDAGE

NO. 1 POWER STATION	60000 KW
NO 2 POWER STATION	60000 KW
NO 3 POWER STATION	28,000 KW
NO. 4 POWER STATION	60000 KW

LEGEND

This colour indicates imaginary cuts in mountains to show works located underground

Indicates road

Indicates race lines

ELECTRICAL LAYOUT
ENLARGED KIEWA PROJECT

PLATE No. 4