CHAPTER XXV.

ELECTRIC POWER GENERATION AND DISTRIBUTION.

This chapter is based on an article which was dealt with in greater detail in Official Year Book No. 39 and was originally contributed by the Division of Industrial Development of the Commonwealth Ministry of National Development. The chapter is divided into three major parts, viz. :—A.—Introduction, which deals briefly with the resources, generation and distribution, and future developments, of electric power in Australia ; B.—The Snowy Mountains Hydro-electric Scheme ; and C.—The origins, development, present situation and new projects of electrical systems in each Australian State and Territory (internal and external). A Statistical Summary is appended. A Bibliography listing publications dealing with various aspects of the subject, and maps showing the generating capacity installed, under construction and proposed in the several States and for the whole of Australia, were included in Official Year Book No. 39.

It should be noted that the information contained in the chapter relates to situations existing and projects contemplated early in 1953 and that it may be considerably affected by changes in policy or plans, or by developments in the projects themselves.

A. INTRODUCTION.

1. **Distribution of Population and Location of Power Resources.**—The geographical pattern of electric power generation and distribution in Australia has been affected by two main influences—the distribution of population, with a resulting distribution of industry, and the location of fuel and water resources.

The Australian population between 1939 and 1952 increased by approximately 1,750,000 to reach a total of 8,750,000. The two principal centres of population and industry, the metropolitan areas of Sydney and Melbourne, make the greatest demands for electric power. Their growth has been associated with the development of large deposits of coal located in relatively close proximity to the source of demand. This, together with the fact that the major water resources are also located in the south-eastern portion of the Commonwealth, is of paramount significance in influencing the distribution of industrial population and the location of major electric power stations.

By far the most important source of energy used in the production of electric power in Australia is coal. At 30th June, 1952, thermal power stations represented 81 per cent. of the total installed generating capacity. The balance, 19 per cent., was distributed between hydro and internal combustion equipment in the proportions of 12 per cent. and 7 per cent., respectively.

Most of Australia is poorly supplied with water, only 15.2 per cent. receiving an annual rainfall of 30 inches and over. This is confined largely to the narrow coastal strip on the east coast and to Tasmania. The possibility of establishing large thermal stations in inland areas is therefore strictly limited by the lack of sufficient water for feed and condensing purposes.

The only region on the mainland of Australia where land is high enough to receive reliable winter snowfall, and from which reasonably constant water supplies throughout the year can therefore be expected, is the mountain chain which stretches from the high plateaux of south-eastern New South Wales through to the north-eastern highlands of Victoria. The hydro-electric potential of this area is considerable, and plans have been formulated to develop more than 3,000,000 kW. within the next 25 years. The two major construction schemes in this area are the Snowy Mountains and Kiewa projects. Other hydro-electric potential does exist on the mainland on the rivers of the coastal areas of New South Wales and Queensland, but the amount there available is only a small proportion of the potential of the Alpine region. In Tasmania hydro-electric resources have been estimated at about 50 per cent. of the total Australian hydro-electric potential. Whereas on the mainland the chief source of energy is coal, water occupies this position in Tasmania.

2. **Electric Power Generation and Distribution.**—(i) *Ownership of Undertakings.* At the beginning of this century, Australia's electrical undertakings were carried on mainly by private enterprise, but some measure of governmental control was exercised through various electric light and power Acts. This legislation was designed to provide standards of safety, and to define the scope and obligations of the private organizations engaged in production of electric power for sale. As the demand for power increased, particularly from manufacturing industries, supply facilities were expanded and the industry grew rapidly. A trend towards public ownership commenced during the 1914–18 War and became more pronounced after the 1939–45 War. By 1953, all major generating stations supplying the public were, in varying degrees, under the control of State statutory organizations, constituted with the object of unifying and co-ordinating the generation and distribution of electricity supplies within the various States. There are however, still a large number of small private and municipal enterprises generating power for supply to country towns, but, where practicable, central authorities are extending supply to these places. In many areas, however, it has been and remains the practice for central authorities to sell power in bulk to local distributing organizations who undertake local reticulation.

In addition to the private, local government and statutory organizations who generate and/or distribute electricity for sale, there are numerous firms generating power for use in their own establishments, particularly those engaged in mining pursuits remote from the main centres of population. This chapter, however, is concerned mainly with the activities of central electric stations, and the power regularly produced for such internal consumption is, in any case, a relatively small proportion of total power produced.

(ii) *Power Production and Generating Capacity.* In the twenty year period 1931–32 to 1951–52, production of electric power in Australia increased by about 350 per cent. from 2,507 to 11,304 million kilowatt hours. A comparison of the relative amounts produced in each State is shown in the following table :—

PROPORTION OF ELECTRIC POWER PRODUCED IN EACH STATE.
(Per Cent.)

Year.	N.S.W.	Vic.	Q'land.	S. Aust.	W. Aust.	Tas.	Total.
1931–32	42.9	28.1	4.9	5.3	5.1	13.7	100.0
1951–52	41.0	25.9	11.2	7.1	4.6	10.2	100.0

During the 1920's, the demand increased very rapidly as supply was extended to new areas and electricity usage considerably diversified. In that period, consumption increased at a rate of 15 per cent. per annum, which amounted to a doubling of the load about each five years. As the net population increase averaged a little less than 2 per cent. per annum, this was not a significant contribution to the comparatively rapid increase in consumption.

During the depression of the early 1930's demand remained fairly constant, but from 1934 to 1939, as industrial activity regained momentum, consumption increased rapidly each year at a rate of from 8 to 10 per cent. per annum. During the 1939–45 War, power restrictions were imposed on commerce and industry, very few houses were built and, in general, new domestic electric appliances were either in short supply or not available. Despite these conditions, consumption continued to increase, but this was due mainly to rising demand caused by war production.

Since the 1939–45 War, industry and commerce have expanded rapidly, many new houses have been built and the population has increased by approximately 18 per cent. These factors, together with extension of electricity supplies to rural areas and the increased use of domestic electric appliances, have all contributed to bring about a position where the inflated demand for power cannot be satisfied by the existing installed capacity

of central generating stations. During the period 1941–42 to 1951–52 the capacity of electrical machinery installed by secondary industries and utilizing purchased electricity, increased by 100 per cent., namely, from 1.4 million horse-power to 2.8 million horse-power.

At 30th June, 1952, installed generating capacity in Australia totalled approximately 2.6 million kW. compared with 1.6 million kW in 1939, an increase of about 63 per cent. In 1938–39 each kW. of installed capacity produced an average of 3,000 kWh. per annum, compared with an average of 4,300 kWh. in 1951–52. These figures are based on Commonwealth totals; figures for the States vary, depending on such factors as the distribution of demand, number of consumers, and type of equipment employed. In Tasmania, for example, average output per kW. installed was 5,000 kWh in 1938–39 and 5,200 kWh in 1951–52 compared with 2,300 and 3,350 kWh respectively in South Australia.

3. **Future Developments.**—Each central authority has embarked upon constructional programmes to overcome the lag between supply and demand. However, industrial and commercial expansion has continued on a high level, and several projects have been commenced or planned in various parts of the Commonwealth for suburban and main railway line electrification. Other fields directly connected with the demand for power, such as house building, must also be taken into account.

Increases in population, even if unaccompanied by increases in consumption of power per head, would result in overall increases in consumption. The rise in industrial demand, which was very great during the period 1930 to 1952, may be expected to continue, even though the rate of increase slows down; this will further add to the demand for power.

An important factor to be considered in regard to future development is the increasing relative importance of the generation of electric power from water resources.

B. SNOWY MOUNTAINS HYDRO-ELECTRIC SCHEME.*

1. **Geography of Area.**—The Snowy country in south-eastern New South Wales is the only part of the continent in which any altitudes exceed 7,000 feet, and in which there is a substantial area over the altitude of 6,000 feet. The precipitation which results from the presence of this barrier on the line of the prevailing winter depressions of Antarctic origin amounts to as much as 120 inches a year in the vicinity of Mt. Koscuisko, the highest point in Australia. The drainage from the snowfields is practically all to three systems—those of the Murray and Murrumbidgee Rivers, which flow inland, and that of the Snowy, which flows southwards to Bass Strait.

2. **Historical.**—The Murray and Murrumbidgee have been subject to control and intensive development for irrigation for many years; the Snowy, however, flows through mountainous and practically uninhabited country until debouching onto the river flats of East Gippsland, not many miles above its mouth. It has never been controlled in any way, either for the production of power or for irrigation, and a very great proportion of its waters flows to waste into the sea. As a result, attention has long been directed towards this river, which has the highest source of any in Australia and which conducts away a very large proportion of the waters from the south-eastern New South Wales snowfields, and it has been consecutively considered as a means of supplementing the flow of the great inland rivers, a source of water supply to the rapidly growing metropolitan area of Sydney, a means for developing hydro-electric power and, again, as a source of increasing agricultural production in the rich Murray and Murrumbidgee valleys.

The 1939–45 War, and the plans for post-war reconstruction which then originated, led to a proposal by the State of New South Wales for diversion for irrigation and agricultural purposes of the waters of the Snowy to the Murrumbidgee River—a scheme in which little emphasis was placed on the generation of power. The Victorian Government proposed a counter-scheme, involving very much greater generation of power, and involving diversion, not to the Murrumbidgee, but to the Murray.

* *See also* Chapter XXVI.—Water Conservation and Irrigation, §3, para. 4.

The Commonwealth Government, however, being seized with the national implications of these proposals, brought about a meeting in 1946 of Commonwealth and State representatives to discuss the general utilization of Snowy waters, and subsequently a Committee was set up to examine the whole question on the broadest possible basis. This Committee, in a report submitted in November, 1948, suggested consideration of a far greater scheme than any previously put forward. It involved not only the simple question of utilization of the waters of the Snowy, but a general consideration of the possible diversion of a number of rivers in the area, tributaries, not only of the Snowy, but of the Murray and Murrumbidgee. The recomendations of the Committee were generally agreed to by a conference of Ministers representing the Commonwealth and States of New South Wales and Victoria, and it was also agreed that the Committee should continue its investigations. A further report was submitted by the Committee in June, 1949, as a result of which the Commonwealth Parliament passed the Snowy Mountains Hydro-electric Power Act. In the next month the Snowy Mountains Hydro-electric Authority was constituted, and thus was inaugurated the greatest engineering scheme in Australian history.

3. **Description of Scheme.**—(i) *General.* The proposals at present being implemented fall into two groups, Tumut Development and Snowy-Murray Development—each having its associated plans for hydro-electric power production. The features described hereunder may be identified by reference to the map on page 1039. It should be remembered that, as the final designs for practically every element of the scheme have not yet been completed, and in many cases will not be completed for many years, any figures which are now quoted in respect of those elements will undoubtedly be subject to modification in the future.

(ii) *Tumut Development.* The central feature of this part of the plan is diversion to, and regulation of, the waters of the Tumut River, a stream at present completely unregulated, but which contributes approximately half of the flow of the Murrumbidgee River at Gundagai below the existing main storage on the Murrumbidgee at Burrinjuck. To the Tumut will be diverted the waters of the Eucumbene, a major tributary of the Snowy, and the headwaters of the Tooma, a tributary of the Upper Murray. The headwaters of the Murrumbidgee itself will also be diverted to the Tumut, principally to secure desirable electric power.

A major dam is to be constructed on the Eucumbene River at Adaminaby, creating a storage of at least 3.5 million acre feet, and from this, water will be conveyed by a 14-mile tunnel to Tumut Pond on the upper reaches of the Tumut River, where it will be joined by the waters from the Tooma, diverted by racelines and tunnels. From Tumut Pond, another tunnel will convey the water to power station T.1 with an installed capacity of about 320,000 kW., and a further tunnel to power station T.2 with a capacity of 280,000 kW., thence discharging into a smaller storage at Lob's Hole.

To the Lob's Hole Reservoir will also be brought the waters of the Upper Murrumbidgee from another major storage at Tantangara, holding 600,000 acre feet. From it, waters will be led by tunnel to power station T.3 with an installed capacity of 140,000 kW., which will discharge into a pond on the Yarrangobilly River, a tributary of the Tumut, and from Yarrangobilly Pond by further tunnel to power station T.4 with an installed capacity of 160,000 kW. which, in turn, will discharge into the Lob's Hole Reservoir.

Between the foot of the Lob's Hole storage and the top of the Blowering storage will be power stations T.5 and T.6. The total capacity of these stations will be 410,000 kW.

The Blowering storage with its capacity of about 800,000 acre feet, is an adjunct to the Snowy Mountains Hydro-electric Scheme and will be required for the regulation both of the Tumut waters and of the waters diverted into the Tumut. This regulation is essential if the waters impounded are to be fully utilized for irrigation purposes. At the foot of the Blowering Dam will be the last of the Tumut Power stations, T.7, with a capacity of some 50,000 kW., but this station will operate only when water is released for irrigation. The State of New South Wales will be responsible for the construction of the Blowering works.

The total extra new water which will reach the Murrumbidgee is expected to average 528,000 acre feet per annum and the total installed capacity of the various power stations is estimated at 1,310,000 kW. (excluding T.7).

(iii) *Snowy-Murray Scheme.* The central feature of this part of the scheme is the diversion of the waters of the Upper Snowy itself from a major dam to be constructed at Jindabyne on that river, a little below its junction with the Eucumbene and the Crackenback Rivers. This reservoir will have a storage capacity of approximately 1,200,000 acre feet and from it will run right through the Great Dividing Range a tunnel approximately 32 miles in length, finally discharging into Swampy Plains River, not far above its junction with the Murray proper.

Into this tunnel will be collected a considerable quantity of water from the very high altitude country of the Kosciusko area, and from a number of smaller tributaries of the Murray. The collection from the Kosciusko area commences at the Kosciusko Reservoir at an altitude of 5,725 feet, not many miles below the source of the Snowy. A tunnel will convey water from this reservoir to power station M.1.A. with an installed capacity of 60,000 kW., and thence to a pond on the Snowy River, at its junction with the Guthega River.

From the Guthega Pond, a further tunnel and penstock will lead to station M.1.B. with a capacity of 90,000 kW., which discharges into a pond at the junction of the Munyang and Snowy Rivers. Construction of this part of the scheme has already commenced. Munyang Pond will discharge into a tunnel leading to station M.2 H. and L. with installed capacity of 60,000 kW., thence into a reservoir at Island Bend on the main stream of the Snowy.

From the Island Bend reservoir, a vertical shaft, 1,000 feet deep, will lead to the main tunnel from Jindabyne reservoir previously referred to, passing on its way through power station M.3 with installed capacity of 250,000 kW. Into this main tunnel will also be collected waters from the Upper Murray tributary streams previously mentioned.

Of these, the most important is the Windy Creek–Geehi River series. A pond on Windy Creek, a small tributary of the Geehi, situated at an altitude of over 5,000 feet, will provide water through a tunnel to station M.4 with an installed capacity of 50,000 kW., thence by racelines and tunnel to station M.5.H. with an installed capacity of 65,000 kW., discharging into Geehi River Pond.

A vertical shaft will lead this water into the main tunnel, passing through station M.5.L with an installed capacity of 20,000 kW. The combined waters thus collected into the main tunnel will pass through station M.6 with an installed capacity of 540,000 kW., and then discharge into a pond on Bogong Creek, another of the Upper Murray tributaries. At this point, the water is still at an altitude of nearly 2,000 feet, and the main tunnel will thence continue to station M.7 with a capacity of 540,000 kW.

From M.7 the total collected waters will flow into the Swampy Plains River at a point some seven miles, in a direct line, above its confluence with the Murray. It will be necessary, however, to provide on the Murray a further storage for the proper regulation of these waters for irrigation purposes.

The total water flowing to the Murray from these works will amount on the average to 722,000 acre feet per annum, but as 280,000 acre feet which now reaches the Murray from the Tooma will be, as indicated previously, diverted to the Tumut, the total extra water actually reaching the Murray will be, on the average 442,000 acre feet per annum ; the total installed capacity of the power stations will be 1,700,000 kW.

An integral part of each development is the construction of hundreds of miles of racelines, to collect and divert water from the many streams in the area into storages and tunnels.

4. **Utilization of Power.**—The total capacity of all stations in the scheme will be of the order of 3,000,000 kW., which is greater than the present total installed capacity of all the generating stations in the Commonwealth.

If, however, the demand for power continues to increase as is expected, the major source of power must still be thermal stations. The operation of the whole scheme is dependent on the appropriate development and integration of these stations, as otherwise there would be a serious loss in ultimate economy; all economic estimates therefore postulate that thermal capacity will be expanded so as to preserve an appropriate ratio.

For the purposes of general comparison, the ratio of 38 per cent. for effective capacity of hydro power to 62 per cent. thermal has been adopted. This, however, is only tentative and may be departed from as the scheme proceeds. It has, however, been estimated with a reasonable degree of probability that the power available from the scheme will save coal to the order of five million tons annually.

The first call on the power generated under the Snowy Scheme will be by the Commonwealth Government for supply to the Australian Capital Territory of power which it needs in that area, particularly for certain projects with defence significance, and no indication can at present be given as to how great that call will be. It is not likely, however, to amount to more than a relatively small fraction of the total power available, and it has been agreed that the balance will be divided between the States of New South Wales and Victoria in a proportion of two-thirds to New South Wales and one-third to Victoria.

The project has not yet proceeded so far that plans can be formulated for the actual scheme of power distribution, but transmission lines from the Australian Capital Territory via Cooma are under construction and, whereas this is primarily to supply power from the existing New South Wales network to the operational sites for construction purposes, it is anticipated that, when station M.I.B. comes into operation, power will then be fed from that station back to the interconnected network. The original estimates for transmission costs in the proposal were based on transmission to load centres at 220,000 volts, but it is probable that much higher voltages will be used.

C. STATES AND TERRITORIES.

§ 1. New South Wales.

1. **General.**—In the previous issue of this Year Book (No. 39) an account is given in some detail of the origin and development of electricity generation and distribution in New South Wales, describing in particular the growth of the systems of the Sydney County Council, the Department of Railways, the Electric Light and Power Supply Corporation Ltd., the Southern Electricity Supply and the Clarence River County Council. A description is also given of the legislation existing prior to, and that which constituted, the Electricity Authority of New South Wales and the Electricity Commission of New South Wales. At present, the three main Acts governing electricity supply in New South Wales are :—

(i) The Local Government Act 1919 which lays down the various rights and responsibilities of local government bodies in the establishment and operation of electricity trading undertakings.

(ii) The Electricity Development Act 1945-1948 which established the Electricity Authority of New South Wales as the body responsible for the co-ordination of electricity supply throughout the State.

(iii) The Electricity Commission Act 1950 which constituted the Electricity Commission of New South Wales as the major generating authority and not subject to the provisions of the Electricity Development Act.

2. **Organization.**—(i) *The Electricity Commission of New South Wales.*—The Commission, which was constituted under the Electricity Commission Act 1950, consists of five members of whom one is a full-time Chairman. In its administration the Commission is directly responsible to the Minister for Local Government.

When the Commission was established, 93 per cent. of the State's power requirements were generated by four bodies—the Sydney County Council, the Department of Railways, Southern Electricity Supply (a division of the Department of Public Works) and the

privately-owned Electric Light and Power Supply Corporation Ltd. The Electricity Commission Act 1950 and the Electricity Commission (Balmain Electric Light Company Purchase) Act 1950 provided for the acquisition of the power stations and main transmission lines of those bodies. The transfer of the power stations and transmission lines of the Sydney County Council, Southern Electricity Supply and the Department of Railways has now been effected. The date of transfer of the undertaking owned by the Electric Light and Power Supply Corporation Ltd. is dependent upon the determination of the valuation of the undertaking by the Land and Valuation Court.

The main function of the Commission is the generation and transmission of electricity which it sells in bulk to distribution authorities (mainly local government bodies) throughout a large part of the State, to the government railways and tramways and to certain large industrial consumers. As the major generating authority, it is also responsible for the development of new power sources. An important exception is the hydro-electric resources of the Snowy Mountains region which are being developed by the Snowy Mountains Hydro-electric Authority, a Commonwealth Government body.

(ii) *Other Electricity Supply Authorities.* The retail sale of electricity to the public is, in general, carried out by separate electricity supply authorities—municipal and shire councils, electricity county councils (consisting of a grouping of shire and/or municipal councils) or private franchise holders. There are 141 of these supply authorities throughout the State of which 46 also generate part or the whole of their power requirements. A few authorities—the most notable being Tamworth City Council and Northern Rivers County Council—also supply in bulk to other councils. The great majority of country power stations are, however, small oil engine plants which are becoming increasingly costly to operate. Consequently, they are gradually being closed down as the main transmission network is extended further afield.

Over the past few years there has been a distinct trend towards the consolidation of supply areas, many of which have been regarded as being too weak individually to form satisfactory areas for distribution. Generally these consolidations have taken the form of a county district consisting of a number of neighbouring shire and municipal areas grouped for electricity supply purposes only and administered by a county council of representatives elected by the constituent shire and municipal councils.

It is interesting to note that of the 243 shires and municipalities in New South Wales, 121 are included in one or other of the nineteen electricity county districts. Thirteen of these county districts have been constituted since 1945. The largest of the county councils is the Sydney County Council which at the close of the year 1952 was supplying 315,000 consumers in the Sydney Metropolitan Area. Unlike the other county councils, which are constituted under the provisions of the Local Government Act 1919, the Sydney County Council was specially constituted under the Gas and Electricity Act 1935.

(iii) *The Electricity Authority of New South Wales.*—The Electricity Authority was constituted under the Electricity Development Act 1945 for the stated purpose of promoting and regulating the co-ordination, development, expansion, extension and improvement of electricity supply throughout the State. The Authority, which is a regulatory body only, consists of seven members of whom one is a full time Chairman. Like the Commission, it is responsible to the Minister for Local Government.

The main functions of the Authority are as follows :—

(a) *Distribution.* Under the Act the approval of the Authority is required, *inter alia*, for the establishment or extension of power stations and main transmission lines (except those controlled by the Electricity Commission of New South Wales); for the establishment or acquisition of an electricity trading undertaking by a local government council; for the granting or renewing by such a council of electricity franchise agreements or corresponding agreements with other councils; and for the giving or taking of bulk supplies of electricity. It also has power to formulate proposals for the establishment of county councils.

In exercising these powers the Authority is mainly concerned to see that distributing authorities are sufficiently strong to provide an economical, efficient and satisfactory service. Its most important activities in this regard are in investigating supply areas and in making recommendations to the Minister for the consolidation of such areas into county districts. Many of the new county districts referred to earlier have been formed largely as a result of the Authority's advice.

(*b*) *Rural Electrification.* The Authority administers the rural electricity subsidy scheme under which rural electrification throughout the State is progressing very rapidly (*see* below).

(*c*) *Safety.* The Electricity Development Act 1945-1948 contains provisions for the making of regulations relating to most aspects of safety and these powers are being used more and more extensively. Safety regulations now in force cover such matters as inspection of consumer's installations, licensing of electricians and electrical contractors, approval of electrical appliances and safety of linesmen.

(*d*) *Generation and Transmission.* The approval of the Authority is required for the establishment of new power stations or the extension of existing power stations (with the exception of those of the Electricity Commission). The Authority may, for example, refuse approval for the establishment of a new power station if it is more economical and in the general interest for the supply authority concerned to purchase in bulk from another body.

3. **Generation and Transmission.**—(i) *General.* Except in the Snowy Mountains district, and in one or two other areas, New South Wales is lacking in major water power potential and for the generation of electricity, the State is, therefore, mainly dependent on steam power stations. Coal-fired stations generate 93 per cent. of the State's requirements, hydro-electric stations 3 per cent. and internal combustion plant 4 per cent.

The proportion of power generated in hydro-electric stations will increase considerably in the future with the development of the Snowy Mountains Scheme by the Commonwealth Government. The possibility of developing the hydro-electric potential of the Clarence River and other rivers is also being investigated. Nevertheless, coal-fired steam power stations will continue to supply the greater part of requirements.

(ii) *Major Generating Stations.* In New South Wales the generation of electricity has followed the general world trend towards large centralized power stations supplying large areas through inter-connected networks. The greater part of the coal-fired generating plant is now concentrated within the bounds of the major coal fields, where the big industrial centres and most of the population are also located.

The major power stations within the main inter-connected system and their installed capacities are as follows :—*Steam*—Bunnerong "A" and "B" (Sydney), 328,000 kW.; White Bay (Sydney), 140,000 kW.; Pyrmont "A" and "B" (Sydney), 98,000 kW.; Ultimo (Sydney), 79,500 kW.; Zarra-street (Newcastle), 79,250 kW.; Balmain (Sydney), 48,000 kW.; Port Kembla, 33,500 kW.; Lithgow, 22,500 kW.; *Hydro*—Burrinjuck (near Yass), 20,000 kW. There are also various other steam, hydro and internal combustion stations aggregating 23,000 kW. The total installed capacity of the main inter-connected system is 871,750 kW.

It will be seen therefore that the greater part of the State's generating plant is concentrated within a hundred mile radius of Sydney—that is, at Sydney itself (five stations), Port Kembla, Newcastle and Lithgow. The largest single station outside this area is located at Tamworth. At present there is only one hydro-electric station in New South Wales with an installed capacity of more than 10,000 kW. This is the Burrinjuck station in south-eastern New South Wales with an installed capacity of 20,000 kW. Other hydro-electric stations are located at Wyangala (near Cowra), Nymboida (near Grafton), Brown Mountain (near Bega), Mullumbimby, Batlow and Tumbarumba. These stations are, however, very small compared with the major steam power stations.

(iii) *Interconnected Network.* About 92 per cent. of electricity consumers in New South Wales are now supplied through the interconnected systems. In this network, transmission lines operating mainly at 66,000 or 33,000 volts interconnect the various power stations and distribute power to load centres throughout most of the south-eastern portion of the State and the north coast region. Three 132,000 volt transmission lines have also been completed—one, completed in 1952, linking Burrinjuck and Port Kembla; one, completed in 1952, between Sydney and Newcastle; and one, just completed, between Sydney and Port Kembla. The totalled installed capacity of the interconnected systems, which includes an aggregated capacity of 36,872 kW. for various stations, including the Northern Rivers County District, linked with the main system, is 908,622 kW.

(iv) *Separate Systems and Total State Installed Capacity.* There are a number of separate systems and isolated plants which have not yet been interconnected with the main network and which have an aggregate installed capacity of 53,788 kW. The most notable are the Tamworth system and that of the Bega Valley County Council on the far south coast. The Tamworth system (18,000 kW.) supplies power to an extensive district in the north-east of the State through 66,000 volt and 33,000 volt transmission lines. Some councils along the Victorian border receive bulk supplies from Victorian authorities.

The aggregate installed capacity for the whole of the New South Wales systems and isolated plants is 962,410 kW.

(v) *Future Development.* The following major power stations in Sydney are at present being extended by the installation of additional generating plant:—Pyrmont "B", 150,000 kW.; Balmain, 73,000 kW.; Bunnerong, 50,000 kW.; White Bay, 50,000 kW. Construction is also proceeding on new major power stations on the coalfields at Lake Macquarie, near Newcastle (300,000 kW.), Tallawarra, near Port Kembla (120,000 kW.), and Wallerawang, near Lithgow (120,000 kW.). These stations will be linked with Sydney by 132,000 volt transmission lines, and extensive additions to the 132,000 volt system to supply increasing loads at various centres are also planned. A 132,000 volt system will be established around the outer Sydney Metropolitan Area for the supply of load centres at present fed through 33,000 volt circuits direct from the inner Sydney power stations. In order to help overcome the post-war power shortage as quickly as possible, the Electricity Commission ordered the construction of four 20,000 kW. "package" steam power stations, at Port Kembla, Maitland, Penrith and Liverpool respectively. The first units are now in operation and all should be completed in 1953. Future plans provide for the construction of a hydro-electric power station on the Hume Reservoir of 25,000 kW. capacity to be connected to the State network through a 132,000 volt transmission line between Hume and Wagga Wagga.

In addition to the power stations mentioned above which are under construction or planned for the system controlled by the Electricity Commission, a number of local government bodies have plans in hand for the development of independent power stations. Of these the more important are as follows:—The Northern Rivers County Council is constructing a steam power station at Koolkhan (near Grafton). Immediate plans provide for an installed capacity of 25,000 kW. The first unit of 5,000 kW. is now in operation. The Tamworth City Council is planning the construction of a new steam power station at Gunnedah for the augmentation of supply to the separate system now supplied from Tamworth power station. The initial installation will be 30,000 kW. and the ultimate now envisaged will be 75,000 kW. The North-West County Council has made tentative plans for the establishment of a 10,000 kW. steam power station on the Ashford coalfield. The Ulan County Council is constructing a steam power station of 6,250 kW. capacity on the Ulan coalfield. The New England County Council and the Bega Valley County Council are constructing small hydro-electric power stations on the Oakey River (near Armidale), and Georges Creek (near Bega) respectively.

Preliminary investigations have also been made of the possibilities of developing substantial hydro-electric schemes on the Clarence and Shoalhaven Rivers but no concrete proposals have as yet been adopted.

4. **Rural Electrification.**—When the Electricity Authority of New South Wales was constituted in 1946, one of its first tasks was the devising of a scheme for subsidizing

the cost of rural electrification. At that time only 16,000 New South Wales farms were being served with electricity—less than one-third of those within reasonable reach of public electricity supply systems. In August, 1946 a subsidy scheme was approved by the Government and put into immediate operation. The initial objective of the scheme was the connexion of 24,000 farms and 9,500 other rural consumers. It was estimated that this work (to be carried out by local supply authorities) would cost £6,000,000 of which the Electricity Authority of New South Wales would provide nearly half by way of subsidy. The Electricity Authority derives its funds for the payment of subsidies partly from levies on the major electricity supply undertakings and partly from Consolidated Revenue. The amount of subsidy is based on the estimated cost of a proposed extension and the number of consumers able to be served by the new lines. In order that the funds available for subsidy purposes might be used to the best possible advantage, the scheme is designed to encourage local electricity supply authorities to construct the more economic extensions first.

The scheme has given a remarkable stimulus to electrification in rural areas and it is now evident that the initial objective will be reached well within the scheduled ten-year period. In six years the total number of farm connexions has been doubled—an average of 2,500 farms being connected each year, at an annual cost of about £1,000,000. New South Wales now has the highest percentage of electrified farms on the Australian mainland. At 30th June, 1952 an additional 15,231 farms and 13,140 other rural consumers had been connected, the length of line involved being 8,864 miles. The capital cost of these extensions was £4,500,000 and the amount of subsidy paid, £735,000.

Surveys indicate that with the aid of subsidies, it should be possible to supply, from the public mains, about 70 per cent. of the farms in New South Wales. At the moment that appears to be somewhat near the limit of farm connexions on a reasonably economic basis.

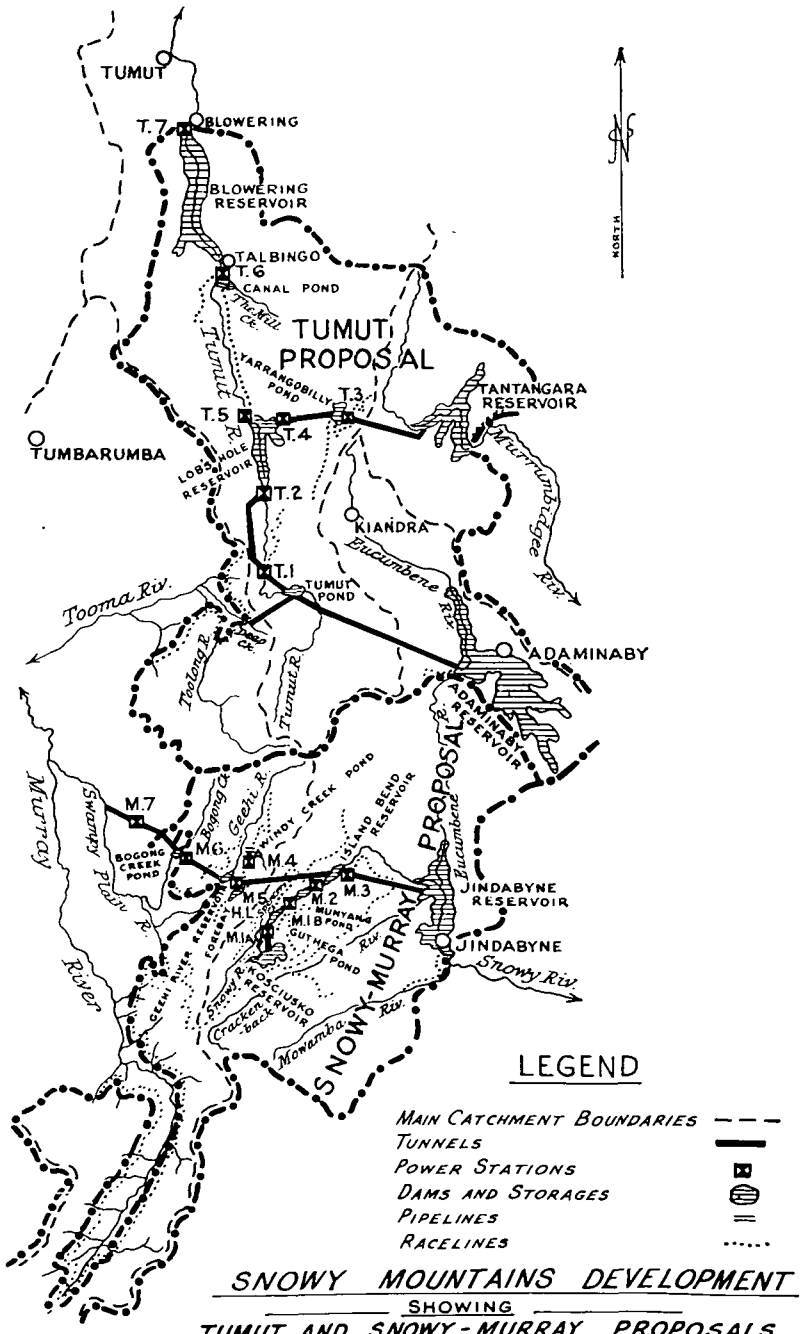
§ 2. Victoria.

1. **General.**—In the previous issue of this Year Book (No. 39) a detailed description is given of the development of electricity generation in the cities of Melbourne, Geelong, Bendigo and Ballarat up to the time of transfer of control of electricity undertakings in these cities to the State Electricity Commission of Victoria. An account is also given of the events culminating in the establishment of the Commission in 1919, and of the early developments in the Commission's undertakings.

2. **The State Electricity Commission of Victoria.**—(i) *Functions of Commission.* Under the terms of the State Electricity Commission Act, three Commissioners were appointed, who took up duty on 4th March, 1919. Their powers authorized them to erect and operate electrical undertakings; to supply electricity in bulk to any corporation; to supply electricity to any person outside any area in which there was an existing undertaking; to carry on any business associated with an electrical undertaking; to make regulations as to precautions to be adopted in the use of electricity and arrange for the licensing of wiremen; and to establish and operate State coal winning projects.

In addition to these powers, the Commissioners were to enquire into and report to the Government as to the steps which should be taken to co-ordinate and concentrate all electrical undertakings in Victoria; to secure the efficient inter-connexion of such undertakings by adopting the necessary standards of plant, voltages, etc.; to encourage and promote the use of electricity for industrial purposes; to report to the Government on the prospects of establishing new industries in Victoria requiring large quantities of electrical energy; and to carry out investigations of coal deposits or hydro-potential that could be used for the generation of electrical energy.

(ii) *Newport and Yallourn Power Stations.* Action was taken to investigate the practicability of utilizing the State's brown coal and water power resources for the production of electricity. In a Report dated 26th November, 1919, the Commissioners concluded, *inter alia*, that the Morwell brown coal field should be developed and a power house established thereon by 1923, with an initial capacity of 50,000 kW. As to water



SNOWY MOUNTAINS DEVELOPMENT
SHOWING
TUMUT AND SNOWY-MURRAY PROPOSALS

power, they were of the opinion that consideration of hydro-electric power schemes should be deferred until further investigations then being undertaken were completed. It was further concluded that in order to obtain maximum economy, the proposed station in the neighbourhood of Morwell (known since 1920 as Yallourn Power Station) and any other power house to be erected in connexion with the proposed State electricity supply scheme should be interconnected with the Railways Department power station at Newport and operated under the control of a single authority.

The actual transfer of the Railways Department station at Newport did not take place until 1951, and in the meantime two new stations (and subsequent extensions) had been constructed by the Commission and were in operation. By the early months of 1953, the total installed generator capacity of the Newport power station, consisting of Newport " A " (originally under the control of the Railways Department), Newport " B " and Newport " C ", was 311,000 kW., which, added to Spencer Street (44,000 kW.) and Richmond (53,000 kW.), made a total of 408,000 kW. installed in the Melbourne metropolitan area, of which all but the 113,000 kW. in Newport " A " power station were included in the 50-cycle inter-connected State generating system.

To implement one of the main purposes for the establishment of the State Electricity Commission, namely, development of Victoria's brown coal resources, particularly for production of electrical energy, construction commenced in 1920 of the Yallourn power station designed for an initial capacity of 50,000 kW., but increased within a few years by the addition of two further machines. On 24th June, 1924, power was first transmitted on a commercial basis from Yallourn to Melbourne. Main metropolitan terminal stations were constructed at Yarraville and later at Richmond.

The site chosen for the power station on the bank of the Latrobe River, about 6 miles from Morwell, had numerous advantages. Adequate water was available for the station's requirements, land nearby provided a good town site, whilst, most important of all considerations, an area of one square mile, adjacent to the proposed station, contained proved reserves of brown coal totalling about 150 million tons with averages of 174 feet thickness and 33 feet overburden. By the use of mechanized methods for open-cut coal winning, the coal could be extracted and delivered to the power station at a cost of only a few shillings a ton. Development of these resources was designed to ensure to a large degree the State's independence in fuel requirements for the production of electrical energy.

Estimated to contain about 10,000 million tons of brown coal, all capable of being won by mechanized open-cut methods, the Yallourn-Morwell brown coal field forms part of the very large brown coal deposits in the Latrobe Valley, where boring has revealed more than 20,000 million tons of brown coal capable of being won by open-cut methods of extraction.

As the Yallourn station was intended to carry the base load of the system, steps were taken to augment its capacity to keep pace with the anticipated and continually increasing demand for electric power, and by 1938, Yallourn "A" and " B " had a total capacity of 175,000 kW. (In addition, an average of 8,000 kW. of by-product electricity is fed into the system from the Yallourn briquette factory.)

(iii) *Hydro-electric Development.* Development of the State's hydro-electric potential the necessity of which was foreseen in the Commissioners' initial Report of November, 1919, but deferred pending further investigations, commenced in 1922. The project selected was dependent on the waters of the Goulburn River and adjacent mountain streams in the Cerberean Range, about 65 miles north of Melbourne. These two sources of water power provided a distinct advantage in that one was mainly summer flow and the other winter flow, thus permitting the continuous generation of power. Five small stations, namely, Sugarloaf (Eildon Weir, 13,500 kW.), Rubicon (9,100 kW.), Lower Rubicon (2,700 kW.), Royston (840 kW.), and Rubicon Falls (275 kW.), were installed totalling approximately 26,400 kW. The complete project was in service by 1929. In conjunction with the building of the new Eildon Dam, the Sugarloaf station is being replaced by one having a total installed capacity of 135,000 kW. It will comprise two

new generators, totalling 120,000 kW. capacity, while the two 6,750 kW. machines in the former Sugarloaf power station are being re-built and re-installed at the revised rating of 7,500 kW. each.

In a Report to Parliament during 1920, the Commissioners included details of a large-scale project for harnessing the Kiewa River in the valleys and tablelands of the Bogong High Plains area of the Main Dividing Range, located approximately 150 miles north-east of Melbourne. At that time the Commission was not prepared to recommend adoption of the plan, but, on the other hand, suggested further consideration of the smaller Sugarloaf and Rubicon scheme. However, during the following 17 years, hydrological investigations were carried out in the Kiewa area which greatly facilitated the subsequent planning of a major hydro-electric project. On 12th June, 1937, a further Report was submitted to Parliament recommending adoption of a plan to provide an ultimate capacity of 117,000 kW. from the Kiewa project. The plan, which included construction of four power stations with an initial installation comprising 20,000 kW. to be in service by 1942, was approved and its provisions embodied in the State Electricity Commission (Extension of Undertaking) Act 1937. Construction commenced during 1938, but the war delayed progress and it was not until September, 1944 that the first station came into partial operation with 13,000 kW.—a second unit of 13,000 kW. was placed in service in April, 1945.

The 1937 Kiewa project, prior to its submission to the Government, was critically reviewed by a group of oversea consulting engineers, and their report confirmed that an enlarged scheme might be possible after further detailed investigation of the water power resources of the terrain adjacent to the Bogong High Plains. On 21st November, 1947, the Commission submitted proposals for expanding the original Kiewa scheme of 117,000 kW. to one of 289,000 kW. with an annual output, averaged over a typical period of wet and dry years, of about 1,000 million kWh. Approval for the amended scheme was contained in the State Electricity Commission Act 1948. Work was begun on the project, but it has since been drastically curtailed because of the shortage of capital funds, and the design is now likely to be somewhat modified.

(iv) *State Supply System.* (*a*) *Growth and Extent.* Since its inception, the Commission has gradually extended the State's system of supply so that it now serves two-thirds of the populated area of the State, in which nine-tenths of the population reside, and certain towns in New South Wales, including Albury. The following comparative table indicates the growth of the Commission's State system between 1929 and 1952.

VICTORIA : STATE ELECTRICITY COMMISSION SYSTEM.(*a*)

Particulars.	Year ended 30th June—			
	1929.	1939.	1949.	1952.
Installed Capacity .. .. kW.	148,000	(*b*)281,400	480,300	517,300 (50 cycle) 113,000 (25 cycle)
Units Generated .. .. m.kWh.	422	898	2,148	2,598 (50 cycle) 193 (25 cycle)
No. of consumers (approx.) (including bulk supply areas)	230,000	368,000	500,000	590,000
Country and Provincial Centres Served	141	419	699	797
Farms Served	700	4,985	14,419	19,953

(*a*) About 98 per cent. of electricity produced in Victoria is now generated by the State Electricity Commission, which also supplies 95 per cent. of consumers. Statistics for 1949 and 1952 include the Commission's regional diesel-electric power station at Hamilton which is not at present connected with the State system. (*b*) Includes Geelong power station (acquired 1st September, 1930) and Ballarat power station (acquired 1st July, 1934, but not in 1939 connected with the rest of the State system); excludes Spencer Street power station, which was not connected with the State system until 1st January, 1941.

During 1951–52 electricity was reticulated to the various classes of consumers in the following proportions—domestic, 36 per cent.; commercial, 14 per cent.; industrial, 44 per cent.; public lighting, 2 per cent.; and traction (excluding railways), 4 per cent.

Since its inception, the Commission has acquired 79 country undertakings in addition to those acquired in the metropolitan area and in provincial cities, and carries out retail distribution throughout its area of supply, except for part of the metropolitan area where 11 municipal undertakings, operating under Orders-in-Council granted before the foundation of the Commission, purchase their electricity in bulk from the Commission. Bulk supply is also given to five New South Wales border municipalities and shires, Albury, Berrigan, Coreen, Corowa and Moama. There remained, in 1952, 54 independent undertakings in various country towns in Victoria generating and distributing their own supplies. Operations of independent undertakings are governed by the Electric Light and Power Act 1928, which the Commission administers.

(*b*) *Composition and Control of Inter-connected Generating System.* Included in the inter-connected State generating system there were at 30th June, 1952 fourteen steam-electric, hydro-electric and diesel-electric power stations located at different centres in the State, and all comprised in one State-wide system. The distribution system comprised more than 16,000 miles of high and low voltage power lines, nine terminal receiving stations and nearly 7,600 distribution sub-stations. The Commission's inter-connected generating system comprises three principal groups of power stations, namely:—

Steam stations.

Yallourn—burning raw brown coal; Metropolitan and provincial stations—burning mainly briquettes and brown coal. (Newport power station also burns black coal, and oil fuel is consumed in all three Metropolitan power stations.)

Hydro stations.

Eildon-Rubicon; Kiewa. (With the closing down of the former Sugarloaf power station, and pending the completion of the new Eildon power station, only the four mountain stream stations in the Eildon-Rubicon group are at present operating.)

Diesel stations.

Shepparton; Warrnambool.

In meeting the total demand on the system which, of course, 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 utilized in a combination that will most economically meet the system load at a given time. For a description of the arrangement of the system thus involved *see* Official Year Book No. 39, p. 1170.

(*c*) *Organization.* In the Commission's organization, the functions of generating and distributing electrical energy are under the control of two separate departments—the Production Department in charge of power stations, brown coal winning, briquette manufacture, terminal stations and main substations, and the Electricity Supply Department, responsible for distribution to consumers. The territory covered by the latter Department is divided into nine areas, each constituting a supply branch. The Metropolitan Branch supplies Melbourne and suburbs, with the exception of certain areas supplied by City Councils reticulating Commission electricity. Energy is supplied by the Production Department to the Metropolitan Branch, and those metropolitan municipal supply authorities which purchase electricity in bulk, at metropolitan terminal stations and a number of main transmission substations. Supply to the Eastern Metropolitan Branch (which has its headquarters at Dandenong) is on similar lines.

Headquarters of the Electricity Supply Department's branches outside the metropolis are located at Ballarat, Bendigo, Geelong, Dandenong (Eastern Metropolitan), Traralgon (Gippsland), Castlemaine (Midland), Benalla (North Eastern) and Colac (South Western).

Supply to the Gippsland Branch is obtained from Yallourn power station at 22,000 volts and by 66,000 volt transmission lines extending within the branch to Maffra in the east, Leongatha in southern Gippsland and Warragul in western Gippsland.

Supply to the Geelong Branch is obtained from the two Geelong power stations and Geelong terminal station, the latter being connected with the rest of the system by a 66,000 volt transmission line to Newport power station.

Supply to the South Western Branch is obtained through Geelong terminal station by a 66,000 volt transmission line extending through Colac to Warrnambool, where the new peak load power station to reinforce supply began operating during 1952.

Ballarat Branch obtains its supply from the two Ballarat power stations which are inter-connected, the larger and more modern power station being connected with the rest of the system by a 66,000-volt transmission line from Sunshine terminal station in the Melbourne Metropolitan area.

Both the Midland and Bendigo Branches obtain their supply through the 66,000-volt power line from Thomastown terminal station, one of the major metropolitan terminal stations in the system.

For the North Eastern Branch, supply is obtained through Rubicon "A" terminal station and the Kiewa hydro-electric undertaking, while local reinforcement of supply is provided by Shepparton power station. Inter-connexion with the rest of the system is provided by the 66,000-volt transmission line extending from Thomastown terminal station to Kiewa via Rubicon "A" and Benalla, with branches to Shepparton and Kyabram, Yarrawonga and Mulwala (New South Wales), and via Wangaratta to Wodonga for supply to Albury.

The Commission also operates a diesel station at Hamilton of 3,020 kW., which is not at present part of the inter-connected system.

(v) *New Capacity.* The Commission is to undertake electric power projects which, provided constructional programmes can be maintained, are designed to increase the installed capacity of the State generating system to approximately 1,000,000 kW. by 1958. This total is exclusive of hydrogenerating plant at the Hume and Eildon Reservoirs, since their use is conditioned by irrigation requirements and they cannot, therefore, be counted upon to meet peak loading on the system which occurs in winter-time. The total is exclusive also of by-product electricity, obtained from the power station to be constructed as part of the Commission's Morwell briquette project.

Major works brought into service since 30th June, 1952, or now under construction include—

(*a*) *Thermal stations.*

Yallourn extension—206,000 kW. (under construction—first set (50,000 kW.) due for completion in 1954).

Morwell—90,000 kW. for the new power station in conjunction with the Morwell briquette project. Of this, approximately 35,000 kW. of by-product electricity will be available to the State system in the first stage (on completion of the first and second factories). A further 35,000 kW. will be available in the second stage (on completion of the third and fourth factories), when an additional 60,000 kW. will be installed.

Metropolitan—83,000 kW. This includes a 38,000 kW. generator at Richmond Power Station completed early in 1953 and 45,000 kW. of new plant at Spencer Street (Melbourne City Council) power station due for completion in 1953 and 1954.

Geelong—30,000 kW. " packaged " units (due for completion, 1953).

Ballarat—20,000 kW. " packaged " units (due for completion, 1953).

Shepparton—10,500 kW. (completed early 1953).
Warrnambool—5,000 kW. (completed early 1953).
(Plant on order also includes a 40,000 kW. steam-electric generator, the location of which has not yet been determined).

(*b*) *Hydro stations.*
Kiewa—126,000 kW. (62,000 kW. station under construction and tunnelling started for a 64,000 kW. station; further power stations projected at a later date).
Hume—25,000 kW. representing Victoria's share of a 50,000 kW. power station shared equally by Victoria and New South Wales (under construction).
Eildon Dam—121,500 kW.—comprising 120,000 kW. of new plant and an additional 1,500 kW. from re-designed plant (under construction).

(*c*) *Thermal regional stations.*
Mildura (Red Cliffs)—10,000 kW. This will be a "packaged" power station and is due for completion in 1953. It will not for the present be connected to the State system, but will operate as a regional unit serving the Mildura area.

A 220 kV. transmission line is under construction from the Kiewa project to Thomastown terminal station; and another from Yallourn to Malvern terminal station to reinforce the existing 132,000 volt circuits already linking Yallourn with Metropolitan terminal stations.

The Commission's long-term plans for State-wide extension of electricity supply involve the ultimate construction of a 220 kV. transmission line from Kiewa to Mildura by way of Shepparton—a distance of approximately 350 miles. The new regional station at Mildura will function primarily as a peak-load station when the plan is implemented.

The Commission has submitted to the State Parliament its plan for the final phase of rural electrification of Victoria, extending supply to all populated regions of the State. The plan provides for the extension of State Electricity Commission supply to every home in Victoria except for about 15,000 homes located in the most isolated parts of the State. Implementation of this plan has been deferred on account of finance.

§ 3. Queensland.

1. **General.**—In Official Year Book No. 39 an account is given of the growth of electricity generation in Queensland, with particular reference to the City Electric Light Co. Ltd., of Brisbane (now the Southern Electric Authority of Queensland), the Brisbane City Council and the Toowoomba Electric Light and Power Co. Ltd.

The first of these organizations, which was operating in Brisbane well before the end of the last century, now supplies a large part of Brisbane's electric power requirements and a considerable rural area south-east of the city. By 1933 this organization was operating a modern power station at Bulimba, a suburb of Brisbane, with an installed generator capacity of 37,500 kW., from which it supplied more than 16,000 consumers and generated about 60 million kWh. of energy per annum. Capacity at Bulimba "A" is now 95,000 kW.; with this, 449 million units were generated in 1951, while the number of its consumers at 31st January, 1952 totalled 66,862.

The Brisbane City Council established an electricity supply service after the 1914–18 War, and by 1938 it was supplying an area of about 365 square miles, purchasing energy in bulk from a power station located at New Farm (administered by the Tramways and Power House Department) and from the City Electric Light Co. Ltd. Growth of the Council's electrical undertaking and power production is indicated by the following comparisons between 1937–38 and 1951–52 figures, respectively :—Installed capacity, 56,250 kW. and 75,000 kW.; units purchased and generated, 71 million kWh. and 381 million kWh.; consumers, 57,000 and 99,000. In 1951–52 New Farm power house generated 381 million units and the Department of Transport (Tramways) consumed 39 million units.

During 1905, the Toowoomba Electric Light and Power Co. Ltd. established supply in Toowoomba, and now supplies a considerable area including portion of the Darling Downs. Power is generated at the Company's diesel stations of 3,520 kW. supplemented with bulk supplies purchased from the City Electric Light Co. Ltd. In 1940 the company purchased the power undertakings at Warwick, and in 1946 the Killarney undertaking.

The generation and distribution of electric power in Queensland had, until the last decade, tended to lag behind developments in this field in other States of Australia. The comparatively slow growth in the production and consumption of electricity can be attributed to some extent to the absence, prior to 1938, of a central statutory authority constituted to undertake the functions of co-ordinating, unifying and controlling the production and transmission of electric power. In addition, Queensland's vast area, coupled with a low population density, made large-scale rural electrification, elsewhere than in the south-eastern portion of the State which surrounds the major centres of industry and population, an uneconomic proposition.

Before establishment of the Regional Electricity Board in 1945, no attempts had been made to unify or co-ordinate electricity supplies, and rural electrification, apart from reticulation within certain townships, was practically unknown.

2. Royal Commission on Generation and Distribution of Electric Power in Queensland, 1936.—On 5th December, 1935, the Queensland Government, being concerned with the need to develop the State's power resources in the public interest, appointed a Royal Commission to inquire into and make recommendations on matters relating to the generation and distribution of electric power in Queensland. The Commission throughout the inquiry tended to concentrate mainly on proposals for electrification of south-eastern Queensland and establishment of a suitable statutory authority to control and unify the development of electrical undertakings in the State. (An account of the results of its investigations and of the alternative proposals put before it will be found on p. 1182 of Official Year Book No. 39.)

The Commission recommended that, in order to achieve a properly planned scheme for the electrification of the south-eastern area, control of generation and distribution of electric power be vested in the State, or, alternatively, if establishment of an operating commission were not found practicable, that electrification under public control with ultimate public ownership be implemented. The Commission concluded that in areas of Queensland outside the south-eastern portion of the State, except for a section of the country from Townsville north to Mossman and west to Herberton where immediate and detailed investigations should be made, there existed only local problems of generation and distribution, not justifying further consideration at that time.

3. **The State Electricity Commission of Queensland.**—In 1937, the State Government legislated to constitute a State Electricity Commission (legislation administering the generation and distribution of electricity in Queensland prior to the establishment of the Commission is referred to on p. 1181 of Year Book No. 39), which commenced to function during January, 1938—to it was passed administration of the Electric Light and Power Acts 1896–1938. The Commission's main powers were :—to secure a proper and efficient supply of electric power; review tariffs; grant licences to supply electricity; secure the safety of the public; and control and advise electrical undertakings generally. It was thus a controlling authority as distinct from an operating authority. In addition, the Commission was empowered to co-ordinate the industry's development throughout Queensland. Between 1938 and 1952, the number of private companies was reduced by absorption and acquisition from twenty-one to seven, and publicly owned undertakings, by amalgamation into Regional Authorities, from forty-seven to twenty-eight.

By agreement with the Commission in 1939, the City Electric Light Co. Ltd. became co-ordinating authority for provision of electricity in an area of some 10,062 square miles, extending from the New South Wales-Queensland border to Gympie, north of Brisbane. The Company acquired the undertakings at Boonah, Beaudesert, Gympie, Coolangatta, Ipswich, Nambour, Southport, Redcliffe and the Somerset Dam supply and transmission line to Brisbane. Certain restrictions were placed on the Company's

dividend rate, namely, limitation to the rate on Commonwealth bonds plus 2 per cent. During 1940, a similar agreement was made with the Toowoomba Electric Light and Power Co. Ltd. for the supply of electricity in the Toowoomba, Warwick, Killarney and Allora districts, subsequently being extended to cover a comprehensive area of 9,324 square miles, including Stanthorpe and other districts. Transmission line extensions since that year have made supply available to a number of adjacent districts on the Darling Downs. The City Electric Light Co. Ltd. was converted to a public authority by legislation as from 1st February, 1953 (*see* para. 5 below), and the Government has the right to acquire the Toowoomba company in 1954 or later.

Amending legislation, passed by the Queensland Parliament in March, 1948, changed the constitution of the State Electricity Commission from a body corporate to a corporation sole. On 1st July, 1948, a Commissioner for Electricity Supply was appointed in lieu of the previous Commission of four Commissioners. Since its inception in 1938, the Commission has made considerable progress in its task of developing the State's power resources and promoting a more widespread use of electric power. The degree of utilization of electrical energy in Queensland now compares favorably with other States in the Commonwealth.

4. **Regional Electricity Boards.**—With a view to facilitating the control and development of electricity supply in areas of low population density or those having a predominantly primary producing economy, the Government in 1945 passed the Regional Electric Authorities Act. This legislation, as later amended, provides for the creation of regions of electricity supply and constitution of Regional Electricity Boards. The Act provided for transfer to the Boards of local authority electricity undertakings in their regions, and for acquisition by the Boards of privately owned undertakings when purchasing rights fell due. Each Board comprises representatives of local authorities in the region and a representative of the Commission. Financial operations of the Boards are under the control of the Commission.

Soon after passage of the Regional Electric Authorities Act, four regions were defined and four Regional Boards constituted, namely, Wide Bay, Capricornia, Townsville and Cairns. A fifth Board, entitled South Burnett, became an operating authority in October, 1947, but on 1st July, 1951 was absorbed in the Wide Bay Regional Board and the organization is now known as the Wide Bay-Burnett Regional Electricity Board. As power was to be obtained from the Wide Bay Regional Board's station at Howard, the Commission decided that development of the two regions could be planned more effectively by a single authority.

Activities of the four Regional Boards in 1951–52 compared with operations of the stations located in regions in 1945–46, and totals for Queensland as a whole, are shown in the following table :—

QUEENSLAND : REGIONAL OPERATIONS.

Region.	1945–46.		1951–52.	
	Units Generated.	No. of Consumers.	Units Generated.	No. of Consumers.
	m.kWh.		m.kWh.	
Wide Bay–Burnett	13.7	11,467	34.9	18,687
Capricornia	19.5	11,196	41.2	15,777
Townsville	25.8	11,612	62.9	16,475
Cairns	22.7	9,722	52.2	14,654
Total	81.7	43,997	191.2	65,593
Queensland	487.0	194,429	1,242.0	257,576

Generator capacity of the four existing Regional Boards installed at 31st December, 1952 was :—Wide Bay-Burnett, 23,541 kW.; Capricornia, 29,729 kW.; Townsville, 14,350 kW.; Cairns, 12,770 kW.; total, 80,390 kW.

5. **Creation of Southern Electric Authority of Queensland.**—A further major step in electrical progress, comparable with that taken when the agreements with the City Electric Light Co. Ltd. and Toowoomba Electric Light and Power Co. Ltd. were first entered into, was taken by the passing of the Southern Electric Authority of Queensland Act of 1952. This Act constituted the City Electric Light Co. Ltd. as a public authority to be known as the Southern Electric Authority of Queensland.

Two Government representatives are included on the Board of the new Authority, whose establishment prepares the way for the complete amalgamation, in due course, of the electrical undertakings serving the south-eastern Queensland area of supply.

An important advantage gained by the creation of this Authority is that on 30th June, 1968, acquisition of the Authority by the State Government can be effected without the necessity of a cash payment as the Government will have the power to convert the Authority's existing stock to inscribed stock. Furthermore, the replacement of the City Electric Light Co. Ltd. by the Southern Electric Authority as a public body relieves electricity consumers in the Authority's area of supply from the burden of taxation which has hitherto been payable by the City Electric Light Co. Ltd., but will not require to be met by the new Authority. An agreement has been signed between the State Government and the Southern Electric Authority giving effect to the principles contained in the new legislation.

6. **New Capacity.**—(i) *Regions.* To provide for development of the electric power resources in the regions, the State Electricity Commission formulated a ten-year programme divided into two five-year periods. In the first, it was planned to erect main transmission systems to connect existing power stations located within the regions and supplement generating capacity by the construction of new stations. Work on this section of the plan is now nearing completion. In the second period, the transmission system will be extended to more sparsely settled areas, the ultimate purpose being the provision of "ring" transmission lines throughout each region and inter-connexion between the regions.

Work has commenced on a number of new generating stations, including Howard (Wide Bay Region), of which 15,000 kW. was placed in service during September, 1951, Rockhampton (Capricornia Region) of which 22,500 kW. was placed in service during September, 1952 and Townsville (Townsville Region). Each of these stations will have an ultimate capacity of 52,500 kW. and be steam-operated. In the Cairns Region, construction has commenced on the Tully Falls hydro-electric scheme, which is designed for an ultimate installed capacity of 92,400 kW. To augment existing capacity, pending operation of Tully Falls, the Cairns Regional Board has installed sixteen diesel units with a total capacity of 10,310 kW. In addition further plant of a capacity of 1,250 kW. has been ordered to meet anticipated demands.

At Mackay, where supply was first given in 1924, and Bowen, both situated on the coast between the Capricornia and Townsville Regions, the local Councils operate power stations of 5,000 kW. and 1,000 kW., respectively. The Mackay City Council is embarking on a scheme for rural development under an arrangement with the State Electricity Commission. To cater for the anticipated growth in demand, the capacity of its station will be increased to 10,000 kW. by 1954. At Bowen, the Town Council, which established the service in 1925, is extending the station's capacity by installation of one 1,000 kW. unit. During 1935, a small (3,800 kW.) power house—Australia's first underground hydro station—was placed in service at Barron Falls near Cairns. When the Cairns Regional Board was established during 1946, operation of the station passed to the Board's control and now comprises part of its generating plant, supplying an area of approximately 42,000 square miles.

(ii) *Western Queensland.* In Western Queensland, where a number of small isolated generating stations supply power to some of the larger towns, the Commission has evolved a plan to increase and modernize existing capacity. It involves installation of small internal combustion units ranging in size from 100 kW. to 600 kW. according to the load likely to be experienced, and conversion from direct to alternating current supply. The Government is assisting the scheme by subsidy—a feature of electrical development in Queensland. In general, the assistance provided comprises subsidies of up to one-third of capital costs on annual loan charges, with special subsidies of up to 50 per cent. for authorities in isolated areas.

In addition to improving supplies to the larger western towns, a scheme has been devised for electricity supplies for smaller towns in the western districts, where consumers range from 50 to 200. Subsidies of 65 and 60 per cent. will apply in those cases where the number of consumers supplied is less than 100 and 200, respectively. This plan is now being implemented and ten townships in the west of Queensland have been provided with the amenities of electricity. Work is at present proceeding on similar schemes for a further four townships and such supply is expected to be available before the close of 1953. The power is being supplied by small oil driven generating sets with automatic controls, which can be run with a minimum of operating attendance.

(iii) *South-eastern Queensland.* To increase the availability of electric power in the south-eastern area of the State, the two major generating authorities, in conjunction with the Commission, have power station projects under construction which are designed to place in service by 1956 new generating units totalling 203,200 kW. The Southern Electricity Authority is building a station known as Bulimba " B " on a site adjacent to Bulimba "A"—the initial installation comprises 60,000 kW. but the ultimate capacity may reach 180,000 kW. A 3,200 kW. unit at Somerset Dam near Brisbane is expected to be in service during 1953. At Tennyson in the Brisbane area the City Council is constructing a new power station—initial capacity 60,000 kW. which may ultimately be increased to 180,000 kW. To supplement capacity pending operations of these projects, " packaged " generating units totalling 20,000 kW. have been obtained from overseas; of these 10,000 kW. has been installed at Tennyson and 10,000 kW. at Ipswich, both of these "packaged" stations being commissioned early in 1953. In addition to catering for the anticipated increase in demand from industrial and domestic sources, this new capacity will be called on to supply energy for the electrified suburban railways—a project upon which preliminary work has commenced.

(iv) *The Burdekin River Hydro-electric Project.* In the vicinity of Townsville, the Commission, acting on behalf of the Burdekin River Authority, has investigated the proposed hydro-electric development of the Burdekin River. This project is linked with the plan to conserve the waters of the river for irrigation, and surveys undertaken indicate that approximately 80,000 kW. could be generated. It has been estimated that a station approaching this size should meet the requirements of Townsville and the adjacent areas, including the coal mines in the region of Collinsville, for at least 20 years, and by obviating the continuous operation of thermal plant, achieve significant savings in fuel. In addition, construction of this hydro station will obviate the need to install new thermal capacity at Townsville within a relatively short time.

§ 4. South Australia.

1. **General.**—An account referring to the companies generating electric power in South Australia prior to the advent of the Adelaide Electric Supply Co. Ltd., and describing the development of that company's activities, is given in Official Year Book No. 39. Also included in the account is some reference to the early measures of public control over electricity supply in South Australia and the extent to which they were applied, and also to the inquiries into the activities of the Adelaide Electric Supply Co. Ltd. in 1932 and 1935.

Following upon an inquiry instituted by the Government in 1943 relative to measures for increasing electricity supply to the metropolitan area and country districts the Electricity Act 1943 was passed which, *inter alia*, established the South Australian Electricity Commission. However, until the State assumed full responsibility for the supply of electric power, this body was not able to do much more than exercise the formal functions conferred on it by the Act.

Under the provisions of Section 3 of the Adelaide Electric Supply Company Act 1944, a Royal Commission was appointed to inquire into and report upon the supply of electricity by the Company and upon all matters concerning it. The Commission presented its report on 28th August, 1945, the main substance of which was, subject to certain considerations and assumptions, that the Government acquire the assets and liabilities of the Adelaide Electric Supply Co. Ltd., and the responsibility for the generation and transmission of electric power in South Australia be vested in a public authority to be called the South Australian Electricity Trust, or, alternatively, if acquisition were not considered desirable, that prices charged for the supply of electricity by the Company be fixed by regulation and determined from time to time by a Committee appointed by the Governor in Council, giving due regard to the interests of the public and a fair return to the shareholders of the Company. The Commission also recommended that an inquiry be held forthwith by the South Australian Electricity Commission regarding the co-ordination of electricity supplies in the State, and that the Commission have power to veto any proposals for the construction of works to generate and transmit electric power.

2. **The Electricity Trust of South Australia.**—Early in 1946, a Bill was passed transferring the assets of the Adelaide Electric Supply Co. Ltd. to the newly formed Electricity Trust of South Australia, which became responsible for unification and co-ordination of the major portion of the State's electricity supplies. This legislation provided that the Trust should take over the powers vested in the South Australian Electricity Commission under the 1943 Act, which, after establishment of the Trust, would cease to exist. In addition to the powers specified in the Adelaide Electric Supply Company's Acts 1897–1931, the Trust may, *inter alia*, supply electricity direct to consumers within a district or municipality with the approval of the local authority, and by agreement with other persons who generate or supply electricity, arrange to interconnect the mains of the Trust with those of other persons, and give or receive supplies of electricity in bulk.

3. **Capacity and Production.**—There are three main categories of organizations generating electric power in South Australia, namely :—(*a*) Governmental, which include the Electricity Trust ; (*b*) Local Authorities, e.g., municipal and district councils, Renmark Irrigation Trust, Municipal Tramways Trust ; and (*c*) Other, including individuals and firms primarily engaged in generating power for sale, firms generating power primarily for their own use but supplying outside consumers, and firms generating power for their own use.

In 1951–52 total installed capacity in South Australia was 221,450 kW. and units generated totalled 761 million kWh. compared with 361 million kWh. in 1941–42.

Of the total installed capacity, the Electricity Trust of South Australia operated plant with a capacity of 158,700 kW. It is thus the most important single authority supplying electricity in the State. There were approximately 191,200 consumers of electricity, of whom about 165,600 were supplied by the Trust. Its major steam stations were Osborne "A" (79,000 kW.) and Osborne " B " (75,000 kW.—since increased to 120,000 kW.) while the balance of the capacity controlled consists of a number of small internal combustion plants located in rural districts.

No hydro-electric potential exists in South Australia. Steam generating units comprise 92 per cent. of installed capacity and the balance, 8 per cent., is internal combustion equipment. Until recently, all fuel consumed in the thermal stations was obtained from sources outside the State, and at times power restrictions were necessary owing to the inadequacy of supplies.

4. **Leigh Creek and other new Capacity.**—With a view to achieving independence of external sources, steps are being taken to install boilers designed to burn locally-mined fuel. Fairly extensive deposits of low-grade sub-bituminous coal are obtainable at Leigh Creek, about 370 miles north of Adelaide. Under the Electricity Trust of South Australia Act Amendment Act 1946, the Trust was given authority to develop Leigh Creek coal for use in its own undertakings and to sell or otherwise dispose of any surplus production.

In order to cope with the rapidly increasing demand for power, the Electricity Trust is installing two additional 30,000 kW. units at Osborne "B". These will complete the "B" station which will then have a total capacity of 180,000 kW. Another major work under construction is the regional power station at Port Augusta, where three 30,000 kW. units will be installed, the first of which is due to be commissioned in 1954. One of the principal reasons for locating the station at Port Augusta is its proximity to the Leigh Creek coal, thus eliminating a considerable part of the long and costly haul to Adelaide. A new standard gauge line is to connect Leigh Creek with Port Augusta; a system of power transmission lines is to inter-connect the metropolitan stations with Port Augusta by way of Port Pirie; supply to country areas will also be facilitated or increased. The Trust is responsible for electricity supply from Port Lincoln and, as at 30th June, 1952, operated diesel stations with an installed capacity of 1,725 kW. This will be supplemented by further diesel and steam plant in the Trust's new power station at Kirton Point. Extensions are planned to the existing steam station at Leigh Creek, which include the installation of two steam units each of 1,500 kW.

Present works are expected to increase installed capacity to 230,000 kW. by the end of 1954. Total plant installed and on order is 334,000 kW.

5. **The Municipal Tramways Trust.**—In addition to the instrumentalities mentioned above which are engaged in the generation and distribution of electric power in South Australia, the Municipal Tramways Trust operates a power station of 26,000 kW. at Port Adelaide, which supplies energy for traction purposes. In 1943 a 5,500 kW. frequency changer was installed to form a link between the power stations of the Trust and the Electricity Trust of South Australia to permit interchange of power when necessary. In 1952 the service consumed approximately 36 million kWh. of electricity.

§ 5. Western Australia.

1. **General.**—Electrical undertakings in Perth and Fremantle formerly owned by the Perth City Council, the Western Australian Government Electricity Supply, the Fremantle Municipal Tramways and Electric Lighting Board and other metropolitan municipal and road board supply authorities have now been taken over by the State Electricity Commission of Western Australia. For information on the early history of electricity supply in the metropolitan area *see* Official Year Book No. 39, p. 1189.

2. **Metropolitan Undertaking.**—Statistics relating to activities at the Metropolitan undertaking are shown in the following comparative table:—

WESTERN AUSTRALIA: METROPOLITAN UNDERTAKING.

Particulars.		1928–29.	1938–39.	1951–52.
Plant capacity	kW.	32,000	57,000	103,000
Maximum load	kW.	21,500	33,000	76,000
Units generated	Mill. kWh.	80	137	338
Coal used per unit generated	lb.	3.1	2.77	1.92
Coal used—				
Collie small..	tons	110,460	165,355	289,419
Imported	"	427	3,367	..

As a result of a separate inquiry conducted at the same time as the early investigations into the proposed new station at South Fremantle, a recommendation was made favouring conversion of the East Perth 40 cycle system to the British and Australian Standard Frequency of 50 cycles per second. The recommendation was adopted and implemented by making the frequency of generation at South Fremantle 50 cycles and installing at East Perth a frequency changer able to convert 25,000 kW. of energy from one frequency to the other. Change-over of consumers' plant is proceeding and a large number of important loads are now supplied at 50 cycles.

3. **Kalgoorlie.**—In Kalgoorlie, the Municipal Council in 1895 first established electricity supply and by 1945 it was supplying 3,350 consumers with direct current from a diesel station of 1,350 kW. generating capacity. Primarily established to supply power for the gold mines and for traction, the Kalgoorlie Electric Power and Lighting Corporation operates a steam station of 18,750 kW. and maintains a 22 kV. line of 21 miles to the Celebration mine. Alternating current is also supplied to about 1,000 consumers, and bulk supplies are provided to the Kalgoorlie Electric Tramways Limited. The Corporation's undertaking generates approximately 45 million kWh. and consumes about 100,000 tons of wood fuel per annum.

4. **General Pattern of Electricity Supply.**—The pattern of the generation and distribution of electric power in Western Australia consisted until recently of a number of isolated systems each supplying a particular area. Except in the metropolitan area and in the area embraced by the South-West Power Scheme (*See* para. 6 below). where in both cases electricity supply is in the hands of the State Electricity Commission of Western Australia, local authorities are generally responsible for the supply of electricity for domestic, industrial and traction purposes. In the area between the Great Southern Railway from Northam to Albany and the west coast, however, the State Electricity Commission has now constructed transmission lines to give central station supply to the towns and their surrounding rural areas. In addition, there are several mining companies which generate electricity for use in their mines. In order to cater for the expected growth in demand, capacity of the State's major generating stations is being increased and designs are proceeding for the inter-connexion of the Perth-Fremantle system with the south-western area.

The main load centre of the State is, of course, the Perth-Fremantle area into which is concentrated the major portion of the State's population and industry. The pending inter-connexion between the Metropolitan and Country systems is, however, expected to lead to a gradual decentralization of load.

5. **The State Electricity Commission of Western Australia.**—(i) *Origin and Aims.* In order to ensure an organized and co-ordinated future growth of electricity generation and distribution throughout the State, the Government introduced a Bill in 1945 to establish the State Electricity Commission, which, together with an Electricity Bill, became law early in 1946. Under these Acts, the Commission was given power, *inter alia*, to secure the ultimate co-ordination of all State or other electrical undertakings in the State, to construct and operate power stations and transmission lines and purchase as a going concern and carry on the undertaking of any supply authority. Under the Electricity Act, which should be read in conjunction with, and is subject to, the State Electricity Commission Act, no person or organization is permitted to construct or extend an electricity supply undertaking without consent from the Commission. Local authorities are empowered to operate and construct power stations and other works associated with the supply of electricity, provided that authority is first obtained from the Commission and any proposals are not inconsistent with the Commission's plans.

(ii) *New Projects.* Since its inception in 1946, the Commission has proceeded with the task of increasing generating capacity in an endeavour to cater for a greatly increased demand for power. Long-range plans have been formulated to inter-connect the south-western portion of the State with the Perth-Fremantle system. One of its most important and immediate problems was to increase the capacity of the generating equipment serving Perth and Fremantle. During the 1939–45 War years, it became

evident that growth of demand for electric power would necessitate provision of additional generating equipment in the metropolitan area as soon as possible. Accordingly, the Government Electricity Supply authority commenced design work for a new station of 50,000 kW. capacity. Contracts were let in 1945 and construction commenced on a site selected at South Fremantle, on the coast south of Fremantle proper. Responsibility for completion of this project was given to the Commission under the Act of 1946. As it was considered that an even larger station would be required, provision was made for the installation of two additional units giving an ultimate capacity of 100,000 kW. Steam is furnished by eight boilers designed to use pulverized coal from Collie, which is located about 120 miles from the station. By 1951, two units had been placed in service and the output was being fed into the metropolitan system. The Commission plans to have all units in operation during 1953 and 1954.

Most of the plant at the East Perth power station, which passed to the Commission's control in 1946, is due for retirement. Work is now proceeding upon dismantling the oldest boilers and generators in order to make room within the existing buildings for new and modern plant which will possess the merit of high efficiency, yet may be cheaply installed by requiring a minimum of site preparation, building and distribution expenditure. Current contracts provide for the installation of 30,000 kW. of new plant in this station. A new cooling plant is also being provided.

6. **South-west Development.**—At the request of the Government, the Electricity Advisory Committee in 1945 submitted a report recommending, amongst other things, that a National Power Scheme for the south-west be proceeded with (implementation of the recommendation of a previous Committee in 1939 had been prevented by the conditions then prevailing). The plan provided for acquisition of the existing Collie power station and installation of additional generating capacity, construction of a power station at Bunbury and inter-connexion of the south-west scheme with the metropolitan system. On 12th October, 1946, the State Electricity Commission acquired the Collie power station, which prior to 1946 was owned and operated by the Collie Power Company Limited. At the date of acquisition, the station's installed capacity was 5,000 kW., comprising two steam units. The capacity of the station was increased to 12,500 kW. in 1952.

Since 1950, the Commission has acquired a number of electrical undertakings from municipal bodies and private organizations in the south-west area and is proceeding with arrangements for the purchase of others. In August, 1951, the first portion of the South-West Power Scheme was officially opened at Collie. and many of the south-west towns have now been connected by transmission line to the Collie Power Station. When completed, a system of power lines will reticulate electricity over an area of approximately 1,800 square miles. Tenders have been called for the first two 30,000 kW. units for a new power station at Bunbury, which will be inter-connected by transmission lines to the Collie and South Fremantle stations, permitting an interchange of power between the metropolitan and south-west systems.

§ 6. Tasmania.

1. **General.**—A considerable part of the catchment in Tasmania is at high level, with a substantial natural storage available, and this has made it possible to produce energy at lower cost than elsewhere in Australia, or in most other countries. Other contributing factors to the low costs are that rainfall is distributed fairly evenly throughout the year, with comparatively small yearly variations. The cheap power has caused several large electro-chemical works with high load factor to become established in Tasmania, and as a consequence the system load factor is also very high and at present is 65 per cent.

For information on hydro-electric development in Tasmania prior to the establishment of the Hydro-Electric Commission in 1930 *see* Official Year Book No. 39, pp. 1192–3.

2. **The Hydro-Electric Commission.**—(i) *Present System.* In 1929 the Government passed the Hydro-Electric Commission Act, under which was established the Hydro-Electric Commission, and which vests in the Commission, with some minor exceptions, the right to use the waters of the State of Tasmania and authorizes it to develop and reticulate electric power for all purposes. In 1930 this corporate body took over the State hydro-electric undertaking and the business of the Hydro-Electric Department.

After the creation of the Commission it was decided to utilize the controlled flow of water from the Great Lake and the fall in the level existing between there and the Waddamana forebay lagoon. An earthen dam was built to divert the water from the Shannon River, first into a canal, and then by two pipelines to the Shannon Power Station 258 feet below, where 10,800 kW. was added to the system in 1934. The water, after passing through Shannon Power Station, discharges into the Waddamana Canal, to be used again at Waddamana Power station. It soon became necessary to consider a larger scheme, and in 1933 it was decided to utilize the run-off of a catchment to the west of the Great Lake nearer the regions of heavy rainfall. Construction was started in 1934 and the initial installation of three 15,700 kW. Pelton Wheel turbines operating under a head of 980 feet was placed in service in February, 1938. This and other works made it economical to increase the turbine capacity of the Tarraleah Station to 94,000 kW.

Before the outbreak of the 1939-45 War, it was decided that in order to make better use of the Great Lake storage it would be necessary to increase the capacity of the Waddamana Station and to duplicate the Waddamana canal. Although the war impeded progress, two units of 12,500 kW. had been installed by its termination, while a third unit was put into commission during 1946.

The power station was brought to its ultimate development by the installation of a fourth unit in 1949, which brought the total capacity to 49,800 kW. at Waddamana "B".

Work on the Clark Dam started in 1939, and is now completed. The Butler's Gorge power station at the foot of the dam was put into commission in September, 1951. The single turbine operates at a maximum rated output of 12,800 kW. and to increase the security of the system and to permit variable seasonal loading of Tarraleah, a second canal will be constructed from the Clark Dam to Tarraleah.

(ii) *New Capacity.* The Hydro-Electric Commission is at present engaged upon the most progressive construction programme in its history, and it is expected that the present generating capacity will be almost doubled in 1955, and nearly trebled by 1960. It is considered that at least 1,865,000 kW. of continuous power can be economically developed. So far 218,700 kW. of generating plant is in commission, while present construction is planned to bring this total to 404,500 kW. by 1955. Further construction which has been approved by Parliament and is about to be commenced will increase this to 566,400 kW. There will remain, however, very considerable resources for future development.

The Trevallyn Power Development is being undertaken primarily to meet the requirements of the aluminium industry. It involves the construction of a power station at sea level—though 30 miles from the sea—together with civil engineering works to divert water from the Second Basin in the South Esk River to a power station on the River Tamar, about two miles from Launceston.

The extensive plateau area between the Great Lake and Lake St. Clair drains into two main catchment areas—the Nive River and the Lake Echo—Dee River Catchments. The Tungatinah Power Development will regulate most of these waters and following its completion practically the whole run-off from the Central Plateau will have been brought under control.

The difference in levels between Lake Echo and Dee Lagoon will be about 600 feet and in order to utilize this head, a power station (to be known as Lake Echo Power Station) will be built on the banks of the New Dee Lagoon. It is proposed to install a single generating set in this station and the turbine will have a capacity of 31,300 kW.

Lake Echo will provide the main storage reservoir for Tungatinah Power Station and it will be drawn upon mainly in times of drought. Lake Echo power station will therefore not operate continuously but only when water is needed to augment the natural run-off from the Nive River Catchment.

The Tungatinah Power Development will regulate the run-off from approximately 400 square miles of country. The safe continuous flow will enable about 48,500 kW. to be generated.

However, in view of the considerable pondage available, the station will be used to provide peak load and spare plant capacity. Turbines with a total capacity of 130,550 kW. will therefore be installed. The first two units each of 26,100 kW. were scheduled to be in operation in mid-1953.

Originally the Wyatinah Power Development Scheme called for one power station to be located on the Derwent River near its junction with the Florentine River. It has recently been decided to vary the original plan and, instead of a single power station on the Derwent River near the junction with the Florentine, there will be two power stations, the first on the Nive River about half a mile downstream from the Nive crossing by the Ouse-Tarraleah Road, and the second near the Derwent River approximately one mile downstream from the Florentine junction. The lower station will have a capacity of 38,300 kW. while the upper station will probably have a capacity of 67,100 kW. so that the total capacity of the development will be about 105,400 kW.

There is every indication that the demand for electric power in Tasmania will increase rapidly. The Commission is conducting extensive surveys and investigation of other schemes with a view to further construction after the completion of the present programme

3. **Power Usage by Secondary Industry.**—After 1930, every effort was made to keep pace with anticipated increases in demand by means of a progressive construction policy. The abundant and comparatively cheap supplies of electricity and other natural resources attracted to Tasmania a number of important secondary industries for which energy costs constitute a significant proportion of the total cost of production. Some of the more important organizations and their continuous power demands when plant is operating are as follows :—Electrolytic Zinc Company of Australasia Ltd., 51,000 kW. ; Australian Commonwealth Carbide Company Ltd., 6,500 kW. ; Goliath Portland Cement Company Ltd., 1,800 kW. ; Associated Pulp and Paper Mills Ltd., 8,600 kW. ; Australian Newsprint Mills Ltd., 24,000 kW.; and Australian Aluminium Production Commission, 30,000 kW. (when in production).

§ 7. Commonwealth Territories.

1. **Internal Territories.**—(i) *General.* The electricity supply undertakings at Canberra in the Australian Capital Territory and at Darwin, Katherine, Tennant Creek and Alice Springs in the Northern Territory are operated by the Commonwealth Government. Administration and control of these undertakings is vested in the Commonwealth Department of Works.

(ii) *Australian Capital Territory.* Supply was first established at Canberra during 1915. The Department owns steam stand-by plant of 2,100 kW. capacity which is operated in conjunction with the New South Wales Electricity Commission's generating equipment. The major portion of the Capital City's power requirements are supplied in bulk from the New South Wales inter-connected system. Within the next few years, defence projects at present under construction in Canberra will greatly increase the demand for electrical energy. These requirements will be met from the Snowy Scheme, the first section of which was scheduled for operation in June, 1954, and the power produced is to be fed into the New South Wales inter-connected system at Cooma.

(iii) *Northern Territory.* At Darwin, supply was established by the Town Council in October, 1934, but later, during April, 1937, responsibility for generation and supply was placed in the hands of the Northern Territory Administration. The power station is equipped with diesel generating plant of 2,010 kW. capacity. During 1951, the first

of two new 850 kW. diesel sets was placed in service—it is expected that the second set will be operating in 1953. Small diesel generating units supply the requirements of Katherine, Tennant Creek and Alice Springs.

In 1948 it was announced that the Department of Works and Housing (now the Department of Works) had selected a site for a hydro-electric station on the Adelaide River, 72 miles from Darwin. The scheme is designed to augment supply to Darwin and suburbs when the diesel equipment at present installed is unable to cope with the demand for power. No constructional work has yet been undertaken on the project.

2. **External Territories—Papua and New Guinea.**—Responsibility for the operation and establishment of electrical undertakings in Papua and New Guinea is vested in the Administration of the Territory of Papua-New Guinea, whose headquarters are located at Port Moresby. Diesel equipment totalling 1,372 kW. is in operation at Port Moresby (750 kW.), Samarai (52 kW.), Lae (360 kW.), Madang 50 kW.) and Rabaul (160 kW.). At Wau, New Guinea, supply is provided to a small number of residents in the town by New Guinea Goldfields Ltd., operating under franchise from the New Guinea Administration. At Bulolo, near Wau, Bulolo Gold Dredging Ltd., operates a hydro station of 5,500 kW. Power produced is used to operate the Company's dredges and bulk supplies are provided to the New Guinea Goldfields Ltd.

Vast hydro-electric potential exists in New Guinea—it has been estimated at 15,000,000 kW., but because of the island's location, absence of large load centres and lack of industrialization, only a very small proportion could, at present, be economically developed. However, there are indications that some industrial expansion will be effected in the main centres of population within the next few years.

In 1950 it was announced that the Commonwealth Government had joined with British Aluminium Co. Ltd. of London to locate and develop large capacity hydro-electric schemes in New Guinea. A new company has been formed, known as New Guinea Resources Prospecting Co. Ltd., with a capital of £100,000. The Commonwealth holds 51 per cent. of the shares and has a controlling interest on a board of five members. The agreement for formation and operation of the Company is administered by the Commonwealth Department of Supply, except in matters requiring compliance with the law of New Guinea, when responsibility for administration rests with the Department of Territories. Surveys and comprehensive investigations are in progress.

With a view to providing cheap power in the near future for domestic purposes and also to industry in the Port Moresby, Lae and Rapopo areas, the Department of Territoris has drawn up a plan to construct a number of small hydro-electric schemes in Papua and New Guinea. These projects involve expenditure of more than £1,000,000 over the next three years.

The more important projects and estimated costs are as follows:—Port Moresby (Papua), £192,000; Lae (New Guinea), £200,000; Rapopo (New Guinea), £440,000; Madang (New Guinea), £200,000.

Work has commenced on the Port Moresby project which will have a capacity of approximately 10,000 kW. The estimated cost of smaller schemes is £186,000.

D. STATISTICAL SUMMARY, 1941-42 AND 1951-52.

The following tables which show statistics for each State separately and for the six States combined, relate to:—(i) the numbers and installed capacity of central electric generating stations, (ii) the values of production and output and the average numbers of persons employed in the electricity supply industry and (iii) the amount of electricity generated in both years and the number of ultimate consumers of electricity in 1951-52.

For further statistics of the electricity supply industry (years 1938-39 and 1945-46 to 1950-51) *see* Chapter XXIV.—Manufacturing Industry, pp. 1027-8.

CENTRAL ELECTRIC STATIONS.

1. NUMBER ACCORDING TO OWNERSHIP.

State.	Government.		Local Authority.		Other.		Total.	
	1941–42.	1951–52.	1941–42.	1951–52.	1941–42.	1951–52.	1941–42.	1951–52.
New South Wales ..	6	12	37	36	53	37	96	85
Victoria	8	11	36	33	27	24	71	68
Queensland	1	..	34	35	13	9	48	44
South Australia ..	1	2	14	13	29	17	44	32
Western Australia ..	2	8	31	37	76	55	109	100
Tasmania	1	1	1	..	2	1	4	2
Total	19	34	153	154	200	143	372	331

2. INSTALLED CAPACITY ACCORDING TO OWNERSHIP.

(Kilowatts.)

State.	Government.		Local Authority.		Other.		Total.	
	1941–42.	1951–52.	1941–42.	1951–52.	1941–42.	1951–52.	1941–42.	1951–52.
New South Wales ..	297,750	790,300	363,550	59,337	181,010	213,098	842,310	1,062,735
Victoria	361,940	584,870	49,969	63,173	5,118	3,645	417,027	651,688
Queensland	(a)	..	102,991	147,113	(a)	117,135	171,540	264,248
South Australia ..	(a)	(a)	(a)	(a)	109,356	(a)	144,060	238,675
Western Australia ..	(a)	(a)	(a)	(a)	48,147	(a)	111,795	(a)
Tasmania	(a)	(a)	(a)	..	(a)	(a)	125,180	(a)
Total	833,792	1,888,975	559,899	312,151	418,221	419,656	1,811,912	2,620,782

(a) Not available for publication; included in total.

3. INSTALLED CAPACITY ACCORDING TO SOURCE OF ENERGY.

(Kilowatts.)

State.	Steam.		Hydro.		Internal Combustion.		Total.	
	1941–42.	1951–52.	1941–42.	1951–52.	1941–42.	1951–52.	1941–42.	1951–52.
New South Wales ..	768,134	960,949	25,570	32,655	48,606	69,131	842,310	1,062,735
Victoria	377,337	571,300	26,493	52,419	13,195	27,969	417,027	651,688
Queensland	147,431	224,524	4,666	(a)	19,443	(a)	171,540	264,248
South Australia ..	135,588	(a)	..	..	8,472	(a)	144,060	238,675
Western Australia ..	81,562	(a)	45	..	30,188	(a)	111,795	(a)
Tasmania	..	..	125,180	(a)	..	..	125,180	(a)
Total	1,510,052	2,117,249	181,956	310,634	119,904	192,899	1,811,912	2,620,782

(a) Not available for publication; included in total.

4. VALUE OF PRODUCTION AND OUTPUT: NUMBER OF PERSONS EMPLOYED.

State.	Value of Production.(a)		Value of Output.		Persons Employed.(b)	
	1941–42.	1951–52.	1941–42.	1951–52.	1941–42.	1951–52.
	£	£	£	£	No.	No.
New South Wales	5,042,236	8,744,683	7,379,960	24,243,068	2,315	4,459
Victoria	2,486,413	4,603,839	3,415,892	10,603,024	1,418	2,500
Queensland	654,437	1,521,621	1,250,201	6,058,707	627	1,066
South Australia	750,926	612,434	1,329,798	4,103,834	618	1,399
Western Australia	567,583	(c)	1,365,737	(c)	593	(c)
Tasmania	107,021	(c)	117,271	(c)	106	(c)
Total	9,608,616	17,226,867	14,858,859	49,432,277	5,677	10,663

(a) Value of production is the value added in the process of generation. (b) Average employment over whole year including Working Proprietors. (c) Not available for publication; included in total

CENTRAL ELECTRIC STATIONS—*continued.*

5. ELECTRICITY GENERATED.

State.	Electricity Generated.				Ultimate Consumers 1951–52.(a)
	Total.		Per Head of Population.		
	1941–42.	1951–52.	1941–42.	1951–52.	
	Mill. kWh.	Mill. kWh.	kWh.	kWh.	No.
New South Wales ..	2,656	4,628	944	1,379	854,339
Victoria	1,685	2,964	865	1,288	622,271
Queensland	481	1,242	464	1,017	257,576
South Australia ..	385	788	635	1,080	181,414
Western Australia ..	347	530	731	897	114,978
Tasmania	727	1,145	3,025	3,835	88,234
Total	6,281	11,297	879	1,323	2,118,812

(a) Approximate figures. An "ultimate consumer" is a person, business, undertaking, etc., that has contracted to receive electric power from a public or private organization supplying this service. The number of ultimate consumers is not synonymous with the number of persons served with electricity because one ultimate consumer may embrace three or four persons, e.g., in a household.