CHAPTER XXV.

ELECTRIC POWER GENERATION AND DISTRIBUTION.

This chapter is based on an article contributed by the Division of Industrial Development of the Commonwealth Ministry of National Development which was published in Official Year Book No. 39. The chapter is divided into three major parts. 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.

It should be noted that the information contained in the chapter relates to situations existing and projects contemplated early in 1954 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 1954 increased by approximately 1,910,000 to reach a total of 8,917,000. 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 relatively close 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, materially influences 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, 1953 thermal power equipment represented 82 per cent., hydro 11 per cent. and internal combustion equipment 7 per cent. of the total installed generating capacity.

Most of Australia is poorly supplied with water, only 15.2 per cent. receiving an annual rainfall of 30 inches or over. This is confined largely to the narrow coastal strip on the east coast and to Tasmania. The possibility of establishing large hydro or steam 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. A trend towards public ownership commenced during the 1914–18 War and became more pronounced after the 1939–45 War. By 1954, 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 period between 1938–39 and 1952–53 production of electric power in Australia increased by about 157 per cent. from 4,688 to £12,045 million kilowatt hours.

Since the 1939–45 War, industry and commerce have expanded rapidly, many new houses have been built and the population has increased by approximately 20 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 greatly increased demand for power cannot be satisfied by the existing installed capacity of central generating stations.

At 30th June, 1953, installed generating capacity in Australia totalled approximately 3.0 million kW compared with 1.6 million kW in 1939, an increase of about 83 per cent. In 1938–39 each kW of installed capacity produced an average of 3,000 kWh per annum, compared with an average of 4,050 kWh in 1952–53. 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 5,600 kWh in 1952–53 compared with 2,300 and 3,070 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.

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. Kosciusko, 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.

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

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 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 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.

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 recommendations 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 927. 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 being 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 aqueducts 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 Tantangara 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 28 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 is almost completed. Munyang Pond will discharge into a tunnel leading to station M.2L., with installed capacity of 60,000 kW. This station also receives the flow of a tributary of the Snowy River via station M.2.H. From station M.2.L. the water discharges 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 aqueducts and tunnel to station M.5.H. with an installed capacity of 65,000 kW discharging into the M.5.L. Intake Pond on the Geehi River.

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 aqueducts 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 slightly 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 made 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.1.B. comes into operation, power will then be fed from that station back to the inter-connected 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 Official 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 (now the Northern Rivers 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. At 1st July, 1954 there were 133 of these supply authorities throughout the State of which 44 also generated part or the whole of their power requirements. A few authorities—the most notable being Tamworth City 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 238 shires and municipalities in New South Wales, 121 are included in one or other of the 23 electricity county districts. Seventeen 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 1953 was supplying 312,749 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 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, safety of linesmen and overhead line construction.

(*d*) *Generation and Transmission.* The approval of the Authority is required for the establishment or extension of power stations and main transmission lines (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 2 per cent. and internal combustion plants 5 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 for the foreseeable future.

(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 transmission networks. The greater part of the coal-fired generating plant is now concentrated within the bounds of the major coalfields, where the big industrial centres and most of the population are also located.

As at 1st July, 1953, the major power stations within the main inter-connected system and their installed capacities were as follows :—*Steam*—Bunnerong "A" and "B" (Sydney), 312,000 kW; White Bay (Sydney), 122,000 kW; Pyrmont "A" and "B" (Sydney), 132,000 kW; Ultimo (Sydney), 79,500 kW; Zarra-street (Newcastle), 67,000 kW; Balmain (Sydney), 70,625 kW; Port Kembla, 48,500 kW; Lithgow, 16,000 kW; Penrith, 20,000 kW. *Hydro*—Burrinjuck (near Yass), 20,000 kW. There were also various other steam hydro and internal combustion stations aggregating 59,241 kW. The total installed capacity of the main inter-connected system was 946,866 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, Penrith 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), Dorrigo, Brown Mountain (near Bega), Mullumbimby, Batlow and Tumbarumba. These stations are, however, very small compared with the major steam power stations.

(iii) *Interconnected Network.* Over 90 per cent. of electricity consumers in New South Wales are now supplied through the main inter-connected 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 1942, linking Burrinjuck and Port Kembla; one, completed in 1952, between Sydney and Newcastle; and one, completed in 1953, between Sydney and Port Kembla. The total installed capacity of the interconnected systems, which includes an aggregated capacity of 48,152 kW for various stations, including the Northern Rivers County District, linked with the main system, was 995,108 kW (as at 1st July, 1953).

(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 at 1st July, 1953, had an aggregate installed capacity of 57,994 kW. The most notable are the Tamworth and Muswellbrook Coal Company systems 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 was 1,053,012 kW (as at 1st July, 1953).

(v) *Future Development.* The following major power stations in Sydney are at present being extended by the installation of additional generating plant:—Pyrmont "B", 100,000 kW; Balmain, 50,000 kW; Bunnerong, 50,000 kW; White Bay, 50,000 kW. Construction is also proceeding on new major power stations on the coal-fields at Lake Macquarie, near Newcastle (330,000 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. Future plans provide for the construction of a hydro-electric power station on the Hume Reservoir of 50,000 kW capacity, half of the output to be fed into the New South Wales network through a 132,000 volt transmission line between Hume and Wagga Wagga and half into the Victorian 66,000 volt network.

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 27,000 kW. Two units each of 6,000 kW capacity have been installed and work on further extensions is under way. The Tamworth City Council is planning the construction of a new steam power station at Gunnedah for the augmentation of the council's 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 is establishing a 12,000 kW steam power station on the Ashford coal-field. The Ulan County Council is constructing a steam power station of 6,250 kW capacity on the Ulan coal-field. 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, Shoalhaven and a number of other East Coast 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. Under this scheme local electricity supplies receive subsidies from the Electricity Authority towards the cost of new rural lines. 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. This has been achieved by fixing a limit to the cost eligible for subsidy. Originally this limit was £250 per consumer when averaged over the cost of the whole extension but the limit was raised to £400 in December, 1953. Some subsidy is paid on higher cost extensions but the excess over an average of £400 is not subsidized.

Between August, 1946 and December, 1953 nearly 12,000 miles of new distribution lines in rural areas were erected at a cost of over £6,500,000. These lines served 19,600 farms and 16,100 other rural consumers. At 31st December, 1953 the Electricity Authority was committed to the payment of £2,500,000 in subsidies of which over £1,000,000 had actually been paid. At that time the percentage of farms connected had been raised from 22 per cent. (in 1946) to 47 per cent.

Surveys have indicated 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. This appears to be somewhat near the limit of farm connexions now considered practicable on a reasonably economic basis.

§ 2. Victoria.

1. **General.**—In Official 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. Subsequently, in 1921, a full time Chairman was appointed, in addition to the three part-time Commissioners. 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 (powers which were subsequently extended to include the registration of electrical contractors, and the testing and approval of electrical appliances); 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 brown coal field located at what is now known as Yallourn in the neighbourhood of Morwell should be developed and a power house established thereon by 1923, with an initial capacity of 50,000 kW. As to water 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 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 latter 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 (Melbourne City Council—74,000 kW) and Richmond (53,000 kW), made a total of 438,000 kW installed in the Melbourne metropolitan area, of which 325,000 kW were included in the 50 cycle interconnected State generating system the remainder (113,000 kW) being 25 cycle plant at Newport " A ". Frequency changes with a maximum capacity of 54,000 kW provide for interchange of power between the 50 cycle and 25 cycle sections of the State generating system.

To implement one of the main reasons 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, while, 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 the middle of 1954 Yallourn " A " " B " and " C " (still under construction) had a total capacity of 225,000 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 Dam, 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 Big 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 have been 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 brought into 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 will 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 1953.

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

Particulars.	Year ended 30th June—			
	1929.	1939.	1949.	1953.
Installed Capacity .. .. kW	148,000	(*b*)281,400	480,300	562,300 (50 cycle) 113,000 (25 cycle)
Units Generated .. million kWh	422	898	2,148	2,816 (50 cycle) 204 (25 cycle)
No. of consumers (approx.) (including bulk supply areas)	230,000	368,000	500,000	618,000
Country and Provincial Centres Served	141	419	699	842
Farms Served	700	4,985	14,419	22,326

(*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 1953 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 1952–53 electricity was reticulated to the various classes of consumers in the following proportions—domestic, 37 per cent.; commercial, 15 per cent.; industrial, 42 per cent.; public lighting, 2 per cent.; and traction (excluding railways), 4 per cent.

To 30th June, 1953 the Commission had acquired 79 country undertakings in addition to those acquired in the metropolitan area and in provincial cities. It carries out retail distribution throughout its area of supply, except for part of the metropolitan area where eleven 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 given to the following New South Wales border municipalities and shires, Albury, Berrigan, Coreen, Corowa, Moama and (since October, 1953) Wentworth. There were at 30th June 1953, 55 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, 1953 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 approximately 17,600 miles of high and low voltage power lines, ten terminal receiving stations and 8,600 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. (Supplementary fuels used in metropolitan power stations comprise oil fuel, black coal and coke).

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 were operating for the greater part of 1952–53.

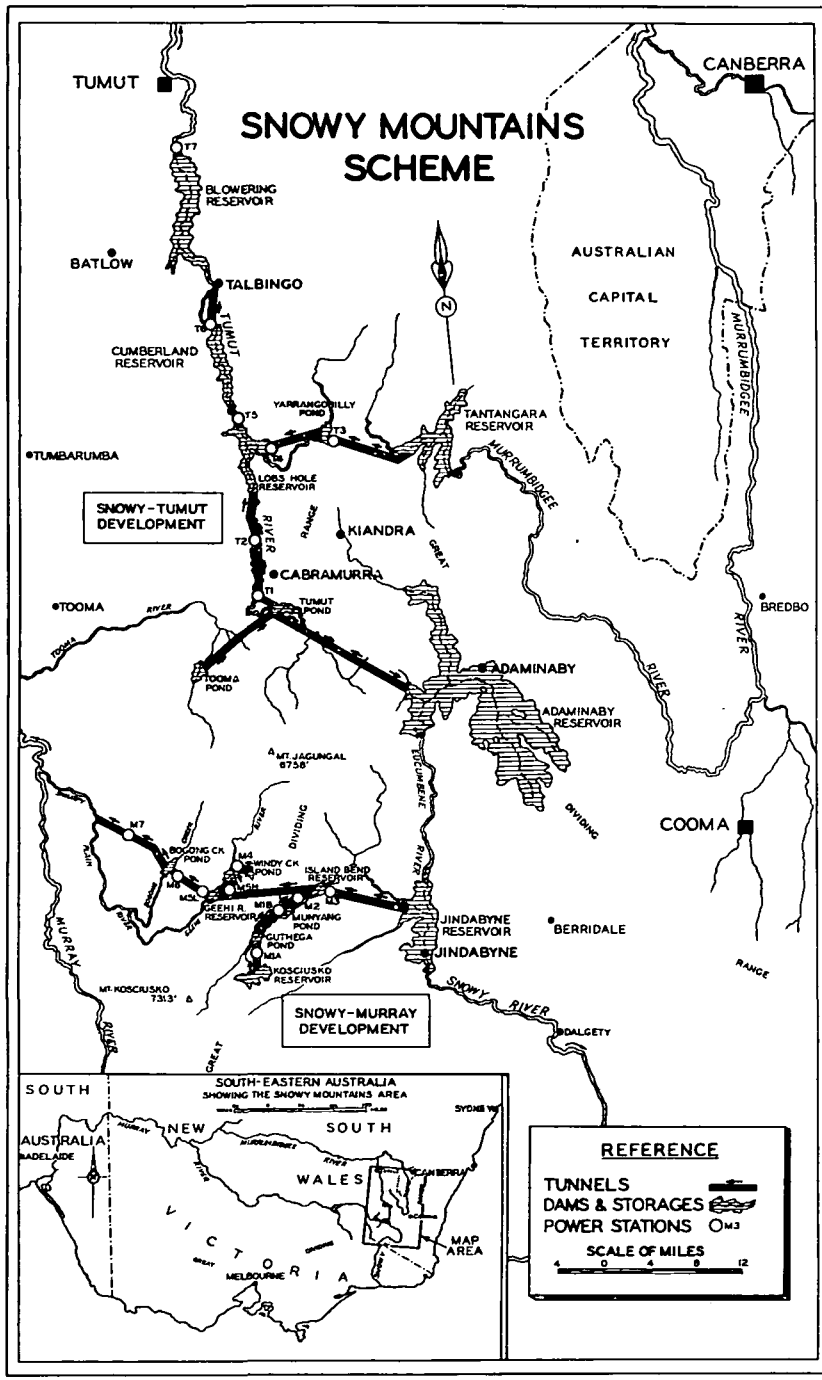
Diesel stations.

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. Energy throughout the inter-connected system is delivered by the Production Department to the Electricity Supply Department from the main transmission network, and not specifically from local power stations, since all power stations in the interconnected system, wherever they are situated feed into a common "pool". The territory covered by the Electricity Supply 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 Dandenong (Eastern Metropolitan), Traralgon (Gippsland), Geelong, Colac (South Western), Ballarat, Castlemaine (Midland), Bendigo and Benalla (North Eastern), Mildura region is a sub-branch of the Bendigo Branch.


SNOWY MOUNTAINS SCHEME
TUMUT
CANBERRA
BLOWERING RESERVOIR
BATLOW
TALBINGO
AUSTRALIAN CAPITAL TERRITORY
CUMBERLAND RESERVOIR
TUMUT
MURRUMBIDGEE
YARRANGOBILLY POND
TANTANGARA RESERVOIR
TUMBARUMBA
LOBS HOLE RESERVOIR
SNOWY-TUMUT DEVELOPMENT
KIANDRA
GREAT
CABRAMURRA
TOOMA
TUMUT POND
BREDBO
ADAMINABY
TOOMA POND
ADAMINABY RESERVOIR
MT. JAGUNGAL 6758'
DIVIDING
COOMA
BOGONG CK POND
WINDY CK POND
ISLAND BEND RESERVOIR
GEEHI R RESERVOIR
MUNYANG POND
JINDABYNE RESERVOIR
BERRIDALE
GUTHEGA POND
JINDABYNE
KOSCIUSKO RESERVOIR
MT. KOSCIUSKO 7313'
SNOWY-MURRAY DEVELOPMENT
SNOWY RIVER
DALGETY
RANGE
SOUTH-EASTERN AUSTRALIA
SHOWING THE SNOWY MOUNTAINS AREA
SOUTH AUSTRALIA
NEW SOUTH WALES
VICTORIA
ADELAIDE
CANBERRA
MELBOURNE
MAP AREA
REFERENCE
TUNNELS
DAMS & STORAGES
POWER STATIONS
SCALE OF MILES

Supply to the Gippsland Branch is obtained from the system via 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 three being inter-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 through the two Ballarat power stations and Ballarat terminal station which are inter-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" switching 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 supplies two independent regions which are not at present included in the inter-connected State supply network, namely, Hamilton and Mildura, the latter having been acquired on 1st October, 1953. Power plant for Hamilton comprises one diesel station (3,020 kW) and for the Mildura region two inter-connected steam stations, namely Mildura (7,000 kW) and Redcliffs (10,000 kW).

(v) *New Capacity.* The Commission is engaged upon electric power projects which, provided construction 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 hydro generating plant at the Hume and Big Eildon Dams, 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.

Major works brought into service since 30th June, 1953, or now under construction include—

(a) *Thermal stations.*

Yallourn extension—206,000 kW (under construction—first 50,000 kW generator in service during winter of 1954—second 50,000 kW generator for completion about the end of 1954).

Morwell—91,000 kW (initial stages), being the generating capacity available for public supply by 1960 at the new power station to be built in association with two new brown coal briquette factories. Further expansion would be possible, but development after 1960 has not yet been decided.

Metropolitan—45,000 kW at Spencer-street (Melbourne City Council) power station, comprising 30,000 kW brought into service for the latter months of 1953 and a 15,000 kW set due for completion during the winter of 1954.

Geelong—30,000 kW " packaged " units (completed, 1954).

Ballarat—20,000 kW " packaged " units (completed, 1954).

(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—62,000 kW station under construction and tunnelling started for another power station of larger capacity; 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—135,000 kW—comprising 120,000 kW of new plant and 15,000 kW from re-designed plant (under construction).

(*c*) *Thermal regional stations.*

Redcliffs (Mildura)—10,000 kW "packaged unit" (completed 1954).

A 220 kV transmission line is under construction from the Kiewa undertaking 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 for Mildura at Redcliffs 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 was, by 30th June, 1953, ahead of schedule.

§ 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 in the south-east corner of the State. 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 is now 92,500 kW at Bulimba "A" plus 10,000 kW, "packaged plant" at Abermain (near Ipswich) and 60,000 kW at Bulimba "B" generating station. A 3,200 kW hydro-electric unit installed at Somerset Dam near Brisbane has also now been commissioned, and the output is fed into the Southern Electric Authority system. With these plants 489 million kWh were generated in 1952–53 while the total number of the Authority's consumers at 30th June, 1953 was 71,179.

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 1952–53 figures, respectively :—Installed capacity, 56,250 kW and 72,500 kW plus a "packaged" plant erected at Tennyson; units purchased and generated, 71 million kWh and 414 million kWh; consumers, 57,000 and 105,145. In 1952–53 New Farm Power house generated 414 million units and the Department of Transport (Tramways) consumed 38 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 3,300 kW supplemented by

bulk supplies purchased from the Southern Electric Authority of Queensland. 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 Boards 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 1953, the number of private companies was reduced by absorption and acquisition from twenty-one to six, and publicly owned undertakings, by amalgamation into Regional Authorities, from forty-seven to forty-two including thirteen new schemes for small Western Queensland towns.

By agreement with the Commission in 1939, the City Electric Light Co. Ltd. (now the Southern Electric Authority of Queensland) became the co-ordinating authority for the 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 as from 1st February, 1953 by the Southern Electric Authority of Queensland Act of 1952 *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 1952–53 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.		1952–53.	
	Units Generated.	No. of Consumers.	Units Generated.	No. of Consumers
	m.kWh		m.kWh	
Wide Bay–Burnett	13.7	11,467	39.3	20,348
Capricornia	19.5	11,196	45.6	16,798
Townsville	25.8	11,612	67.8	16,903
Cairns	22.7	9,722	61.6	15,398
Total	81.7	43,997	214.3	69,447
Queensland	487.0	194,429	1,349.1	290,179

Generator capacity of the four existing Regional Boards installed at 31st December, 1953 was:—Wide Bay-Burnett, 15,000 kW; Capricornia, 22,500 kW; Townsville, 22,500 kW; Cairns, 15,370 kW; total, 75,370 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.

Arrangements have now been concluded whereby the Southern Electric Authority has acquired most of the shares of the Toowoomba Electric Light and Power Co. Ltd., bringing this company's area of supply under its control. The Southern Electric Authority will thus be responsible for the electrical supply and development of a consolidated area of 19,386 square miles.

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.

A number of new generating stations have been commissioned as follows:—Wide Bay (Burnett Region), of which 15,000 kW was placed in service during September, 1951—a further 7,500 kW in 1954 and a further set of 15,000 kW is scheduled for installation in late 1955; Rockhampton (Capricornia Region) of which 22,500 kW was placed in service during September, 1952 and a further 15,000 kW is scheduled for installation in 1955; and Townsville (Townsville Region) of which 22,500 kW was commissioned in July, 1953, with a further 15,000 kW to follow in late 1954 or early 1955. 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 and an 18,000 kW turbo alternator set should be giving a supply of electric power by the end of 1955. The second set of 18,000 kW should be ready during 1956. The schedule is designed for an ultimate installed capacity of 92,400 kW. To augment existing capacity and to meet anticipated demands pending operation of Tully Falls, the Cairns Regional Board has installed seventeen diesel units with a total capacity of 11,410 kW and a further diesel plant of a capacity of 1,250 kW is now in process of erection.

The Tully Falls scheme is planned to eventually link with the Burdekin Falls Hydro-Electric project. These schemes and the existing Barron Falls hydro-electric plant will exploit North Queensland's principal hydro-electric potential estimated conservatively at more than 316,000 kW.

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 4,500 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 9,500 kW in 1954–55. 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, totalling 15,370 kW, 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 cost 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 at 30th June, 1954, fifteen 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 seven townships and such supply is expected to be available before the close of 1954. The power is being supplied by small oil driven generating sets with automatic controls, which can be run with a minimum of operating attendance.

Coal-burning gas producers have been successfully commissioned for public electricity supply purposes in the West. They have been or are now being installed at Longreach, Clermont, Dalby, Blackall and Barcaldine and further extensions of their use in Western Queensland is predicted as lower tariffs and more efficient production of electricity should follow their use.

(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 335,300 kW. The Southern Electricity Authority is building a station known as Bulimba "B" on a site adjacent to Bulimba "A"—60,000 kW has been installed—but the ultimate capacity may reach 180,000 kW. A 3,200 kW unit at Somerset Dam near Brisbane is now in service and feeds into the Southern Electric Authority's system. At Tennyson in the Brisbane area the Brisbane City Council is constructing a new power station—initial capacity 60,000 kW which may be ultimately increased to 180,000 kW. The first 30,000 kW set is expected to be ready early in 1955 and the second set early in 1956. To supplement capacity pending operations of these projects, "packaged" generating units totalling 20,000 kW were obtained from overseas and commissioned early in 1953, one 10,000 kW set has been installed at Tennyson and another 10,000 kW set at Ipswich.

The power stations of the two major generating authorities at New Farm and Bulimba are interconnected at 33,000 volts and bulk supply is provided to the Toowoomba Electric Light and Power Co., from the 110,000 volt transmission system of the Southern Electric Authority.

(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. This project is linked with the plan to conserve the waters of the river for irrigation and flood mitigation and surveys undertaken indicate that approximately 80,000 kW could be generated. It has been estimated that a hydro-electric station approaching this size should meet the requirements of Townsville and the coal mines in the region of Collinsville, for at least 20 years, and also transmit supply to Bowen and Proserpine and possibly to the Mackay area, and

by obviating the continuous operation of thermal plant achieve significant savings in fuel. In addition, construction of this hydro-electric station will obviate the need to install new thermal capacity at Townsville.

§ 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 1952–53 total installed capacity in South Australia was 266,650 kW, an increase of 45,200 kW on the year before. The units generated totalled 806 million kWh compared with 761 million kWh in the previous year.

Of the total installed capacity, the Electricity Trust of South Australia operated plant with a capacity of 206,090 kW. It is thus the most important authority supplying electricity in the State. There were approximately 199,149 ultimate consumers of electricity, of whom 177,934 were supplied by the Trust. Its major steam stations were Osborne "A" (79,000 kW) and Osborne "B" (120,000 kW) while the balance of the capacity controlled consists of a limited 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 reducing the dependence on external sources of fuel, steps have been taken to produce local coal and to install plant to use it. Fairly extensive deposits of low-grade sub-bituminous coal are obtainable at Leigh Creek, about 360 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 also for sale to other consumers. Production from the Leigh Creek field commenced in 1944 and in the year ended 30th June, 1953, 399,546 tons of coal were sold. Of this amount the Electricity Undertaking used 256,000 tons.

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" Power Station. These will complete the "B" station which will then have a total capacity of 180,000 kW. Another major work under construction is the power station at Port Augusta, where three 30,000 kW units will be installed. The first of these will be commissioned in July, 1954. This power station is located at Port Augusta because of its proximity to the Leigh Creek coalfield and the station will use Leigh Creek coal exclusively. A new standard gauge railway line to connect Leigh Creek with Port Augusta is being constructed by the Commonwealth Railways Department. The power station is inter-connected with the Metropolitan Area by two transmission lines which will also supply power at intermediate points. The Trust has now decided to construct a second power station at Port Augusta to be known as Port Augusta "B". This station will have a capacity of 180,000 kW making the combined capacity at Port Augusta 270,000 kW. With the two Port Augusta power stations and the extensions to Osborne "B" station the planned increase in generating capacity is 330,000 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 1953 the service consumed approximately 22 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.	1952–53.
Plant capacity	kW	32,000	57,000	103,000
Maximum load	kW	21,500	33,000	85,000
Units generated	Million kWh	80	137	350
Coal used per unit generated	lb.	3.1	2.77	1.71
Coal used—				
Collie small..	tons	110,460	165,355	266,789
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.

New boilers are now being installed to permit steam raising from Collie coal, since depletion of timber in neighbouring areas has proceeded to the point where firing on wood fuel is no longer economic.

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 the 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 before the end of 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. Contracts have been let for the first three 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 water 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 led to the establishment in Tasmania of several large electro-chemical works with high load factor, 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 10,500 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 15,000 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 90,000 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 12,000 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 48,000 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 12,200 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 by 1960. It is considered that at least 2,400,000 kW of continuous power can be economically developed. So far 286,700 kW of generating plant is in commission, while present construction is planned to bring this total to 572,700 kW by 1960. 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 2 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 altometer will have a capacity of 36,000 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 125,000 kW will therefore be installed. The first three units each of 25,000 kW were put into operation between June and October, 1953 and a fourth unit is scheduled to be in operation in mid-1954.

Originally the Wayatinah 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 1 mile downstream from the Florentine junction. The lower station will have a capacity of 45,000 kW while the upper station will probably have a capacity of 93,000 kW so that the total capacity of the development will be about 138,000 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. 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. The total capacity of the diesel equipment installed is 4,270 kW operating in the following centres—Port Moresby, 2,158 kW; Rabaul 545 kW; Lae, 598 kW; Madang, 230 kW; Samarai, 200 kW; Kaveing, 85 kW; Wewak, 131 kW; Lorengan, 100 kW; and 223 kW distributed among eleven outstations where generating capacity is between 5 kW and 60 kW. New power plant is under construction at Lae (874 kW) and Rabaul (1,451 kW). The townships of Wau and Bulolo are supplied by the Bulolo Gold Dredging Co., which operates a hydro-electric plant of 5,500 kW. This power is produced mainly to supply the alluvial dredges and, in addition, now supplies the recently constructed plywood mill at Bulolo.

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.

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 was 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.

The following hydro-electric schemes are under construction:—Port Moresby—at Rouna on the Laloki River providing 3,000 kW when complete with provision for expansion to 5,000 kW. It is anticipated that the power station should be in operation during 1956. The present project only utilizes portion of the power available from the Laloki River and the economic ultimate development will be to the order of 50,000 kW; Goroka—with an initial capacity of 100 kW and Aiyura (for the Agricultural Experimental Station) with an initial capacity of 30 kW. Stream gauging and other preliminary investigations for hydro-electric schemes have been carried out at Lae, Rabaul and Madang.

D. STATISTICAL SUMMARY, 1948-49 AND 1952-53.

The following table shows statistics for each State separately and for the six States combined for 1948-49 and 1952-53 and relates 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 generating side of the electricity supply industry and (iii) the amount of electricity generated in both years and the number of ultimate consumers of electricity in 1952-53.

For further statistics of the electricity supply industry (years 1938-39 and 1945-46 to 1951-52) *see* Chapter XXIV.—Manufacturing Industry.

CENTRAL ELECTRIC STATIONS.

Particulars.	N.S.W.	Vic.	Q'land.	S. Aust.	W. Aust.	Tas.	Total.
1948–49.							
Generating Stations—							
Government .. No.	10	10	..	2	9	2	33
Local Authority ,,	41	33	36	13	42	..	165
Companies .. ,,	40	25	11	23	65	1	165
Total	91	68	47	38	116	3	363
Installed Capacity of Generators—							
Steam .. kW	869,109	518,950	206,334	(a)	78,225	(a)	1,869,769
Hydro .. ,,	33,155	52,419	4,141	(a)	..	(a)	272,763
Internal combustion ,,	51,581	17,237	25,506	(a)	37,476	(a)	143,476
Total .. ,,	953,845	588,606	235,981	(a)	115,701	(a)	2,286,008
Persons employed(b) No.	3,853	2,059	885	(a)	915	(a)	8,822
Value of output(c) £,000	13,368	5,512	2,893	(a)	2,172	(a)	26,938
Value of production(d) ,,	6,582	2,653	905	(a)	664	(a)	12,233
Electricity generated(e) Million kWh	3,717	2,504	890	567	399	976	9,053
1952–53.							
Generating Stations—							
Government .. No.	18	11	..	7	8	5	49
Local Authority ,,	36	33	43	14	37	..	165
Companies .. ,,	32	24	9	21	50	1	137
Total	86	68	52	42	95	6	349
Installed capacity of Generators—							
Steam .. kW	1,132,699	608,300	303,524	(a)	135,400	(a)	2,434,999
Hydro .. ,,	35,030	52,419	3,960	(a)	..	(a)	313,009
Internal combustion ,,	90,436	35,003	40,334	(a)	45,136	(a)	223,067
Total .. ,,	1,258,165	695,722	347,818	(a)	180,536	(a)	2,971,975
Persons employed(b) No.	4,851	2,608	1,176	(a)	1,003	(a)	10,891
Value of output(c) £,000	26,762	14,095	7,599	(a)	5,110	(a)	60,083
Value of production(d) ,,	10,606	6,352	2,566	(a)	2,200	(a)	24,582
Electricity generated (e) Million kWh	4,868	3,193	1,349	822	569	1,244	12,045
Ultimate consumers(f) No.	897,286	655,055	290,179	199,149	110,521	93,100	2,245,290

(a) Not available for publication; included in total for Australia. (b) Average employment over whole year including Working Proprietors. (c) Value of electricity produced plus certain earnings. (d) Value added to materials and fuel in the process of generation. (e) Total generated including that generated by factories for their own use. (f) Approximate figures supplied by the electricity authority in each State. This detail is not available for 1948–49. 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.