CHAPTER 28

ELECTRIC POWER GENERATION AND DISTRIBUTION

This chapter is divided into three major parts: the Introduction, which deals briefly with the resources, generation and distribution, and future development of electric power in Australia; the Snowy Mountains Hydro-electric Scheme; and the origins, development, present situation and new projects of electrical systems in each Australian State and Territory.

The information contained in the chapter relates to situations existing and projects contemplated in December 1969, and may be considerably affected by changes in policy or plans, or by developments in the projects themselves. Greater descriptive and historical detail about the various systems is contained in earlier issues of the Year Book.

INTRODUCTION

Distribution of population and location of power resources in Australia

The two principal centres of population and industry in Australia, the metropolitan areas of Sydney and Melbourne, make the greatest demands for electric power, and 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 Australia, 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 30 June 1969 thermal power equipment represented 68.5 per cent, hydro plant 29.3 per cent, and internal combustion equipment 2.2 per cent of the total installed generating capacity.

Most of Australia is poorly supplied with water, only about 13 per cent receiving an annual rainfall of 30 inches or over, and these areas are confined largely to Tasmania and to the narrow coastal strip along the east cost of the mainland. The only region on the mainland of Australia high enough to receive reliable winter snowfall, and from which, therefore, reasonably constant water supplies throughout the year can be expected, is the mountain chain which stretches from the high plateaux of south-eastern New South Wales 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 4,000,000 kW by 1975. The two major construction projects in this area are the Snowy Mountains and Kiewa schemes. 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 available is smaller than 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. On the mainland the chief source of energy is coal; in Tasmania it is water.

Electric power generation and distribution

At the beginning of this century Australia's electrical undertakings were carried on mainly by private enterprise, but with some measure of governmental control designed to provide standards of safety and to define the scope and obligations of the private organisations. A trend towards public ownership commenced during the 1914–18 War and became more pronounced after the 1939–45 War. By 1961 all major generating stations supplying the public were, in varying degrees, under the control of statutory organisations constituted with the object of unifying and co-ordinating the generation and distribution of electricity supplies. There are still a large number of small private and municipal enterprises generating power for supply to country towns, although central authorities are extending supply to these places wherever practicable. In many areas it has been, and remains, the practice for central authorities to sell power in bulk to local distributing organisations which undertake reticulation.

In addition to the private, local government and statutory organisations which generate and or distribute electricity for sale, numerous firms generate power for use in their own establishments, particularly those engaged in mining remote from the main centres of population. This chapter, however, is concerned mainly with the activities of central electric stations, as the power regularly

produced for such internal consumption is, in any case, a relatively small proportion of the total power produced. The measures taken by authorities to satisfy the demand created by the post-war growth in population and building and by developments in industry and commerce are described in the following pages.

SNOWY MOUNTAINS HYDRO-ELECTRIC SCHEME*

Snowy Mountains Hydro-electric Power Act 1949-1958

In July 1949 the Commonwealth Government established the Snowy Mountains Hydro-electric Authority, and empowered it to generate electricity by means of hydro-electric works in the Snowy Mountains Area; supply electricity to the Commonwealth (i) for defence purposes, (ii) for consumption in the Australian Capital Territory; and supply to a State, or to a State Authority, electricity not required for defence purposes or for consumption in the Australian Capital Territory.

The Snowy Mountains Act is supported by a detailed agreement between the States of New South Wales and Victoria and the Commonwealth with regard to the construction and operation of the Scheme, the distribution of power and water, charges to be made for electricity, and other such matters. The Snowy Mountains Council, established under the terms of the Agreement and consisting of representatives of the Commonwealth, the Authority and the two States, directs and controls the operation and maintenance of the permanent works of the Authority and the allocation of loads to generating stations.

Snowy Mountains Hydro-electric Scheme

The broad basis of the Snowy scheme is to transfer waters, which would otherwise flow to the sea unharnessed, from the Snowy River and its tributaries to the inland system, so that the water may be used for irrigation and to provide power. It involves two main diversions, the diversion of the Eucumbene, a tributary of the Snowy, to the Upper Tumut River, and the diversion of the main stream of the Snowy River at Island Bend and Jindabyne to the Swampy Plain River. These two diversions divide the scheme geographically into two sections, the Snowy–Tumut Development and the Snowy–Murray Development (*see* plate 50 opposite). For purposes of both power production and irrigation it is necessary to regulate run-off, and this is achieved by the use of Lake Eucumbene (formed by the construction of Eucumbene Dam) and other storages to control the waters of the Eucumbene, Murrumbidgee, Tooma, and Tumut Rivers for the Snowy–Tumut Development and of the Snowy and Geehi Rivers for the Snowy–Murray Development. A sectional diagram of the scheme appears on plate 51, page 952.

Snowy–Tumut Development. This development comprises works for the diversion and regulation of the waters of the Eucumbene, Upper Tooma, Upper Murrumbidgee, and Upper Tumut Rivers and their combined development through a series of power stations down the Tumut River. A major dam has been constructed on the Eucumbene River to create Lake Eucumbene, which has an ultimate usable storage of 3.5 million acre feet. The waters of the Upper Murrumbidgee River are diverted into Lake Eucumbene by a dam at Tantangara and a 10½-mile tunnel from Tantangara Reservoir. From Lake Eucumbene the water flows through a 14-mile tunnel to Tumut Pond Reservoir on the upper reaches of the Tumut River, where it joins the waters of the Tumut River itself and the waters of the Tooma River diverted to Tumut Pond Reservoir by a diversion dam and a 9-mile tunnel.

From Tumut Pond Reservoir water is conveyed by pressure tunnel to Tumut 1 underground Power Station (capacity 320,000 kW), returned to the Tumut River and then by another pressure tunnel to Tumut 2 underground Power Station (capacity 280,000 kW), thence discharging into Talbingo Reservoir, also on the Tumut River.

Tumut 3 Power Station, the largest station of the scheme (generating capacity 1,500,000 kW) and pumping capacity 10,500 cubic feet per second) is being constructed below Talbingo Reservoir and will discharge into Jounama Pondage on the Tumut River. This pondage will provide a downstream pumping pool and also regulate discharges from Tumut 3 Power Station as required. Releases from Jounama Pondage then enter Blowering Reservoir formed by Blowering Dam. This dam, constructed by the Snowy Mountains Authority as an agent for the State of New South Wales, provides for the regulation of power station discharges for irrigation use in the Murrumbidgee Valley. The Authority has constructed a power station at the foot of the dam to generate power from releases of water for irrigation purposes.

Snowy–Murray Development. The principal features of the Snowy–Murray Development are the diversion of the main stream of the Snowy River by tunnels, shafts, and pipelines westwards through

* *See also* Chapter 24 Water Conservation and Irrigation of this issue and special detailed article in Year Book No. 42, pp. 1103–30.

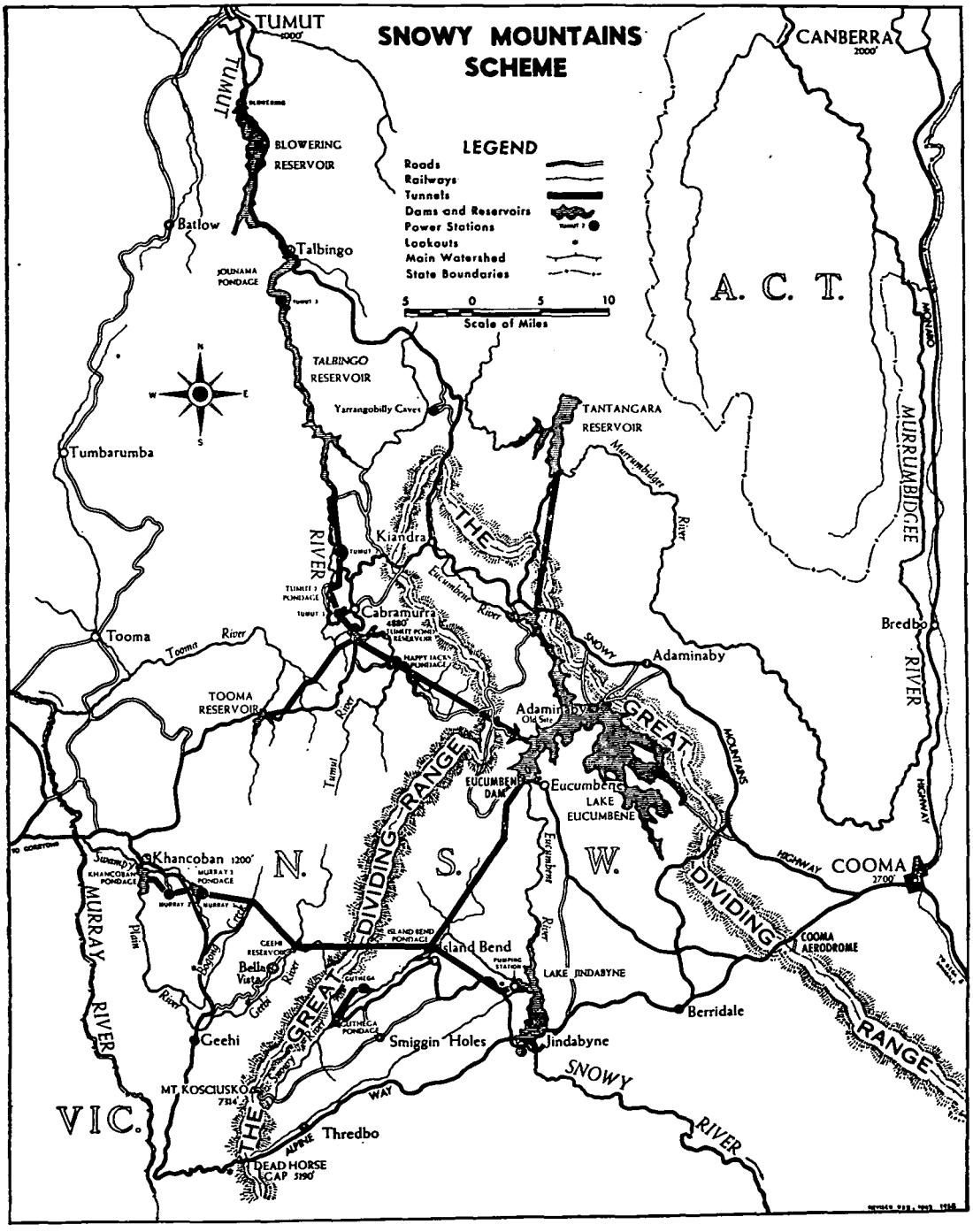
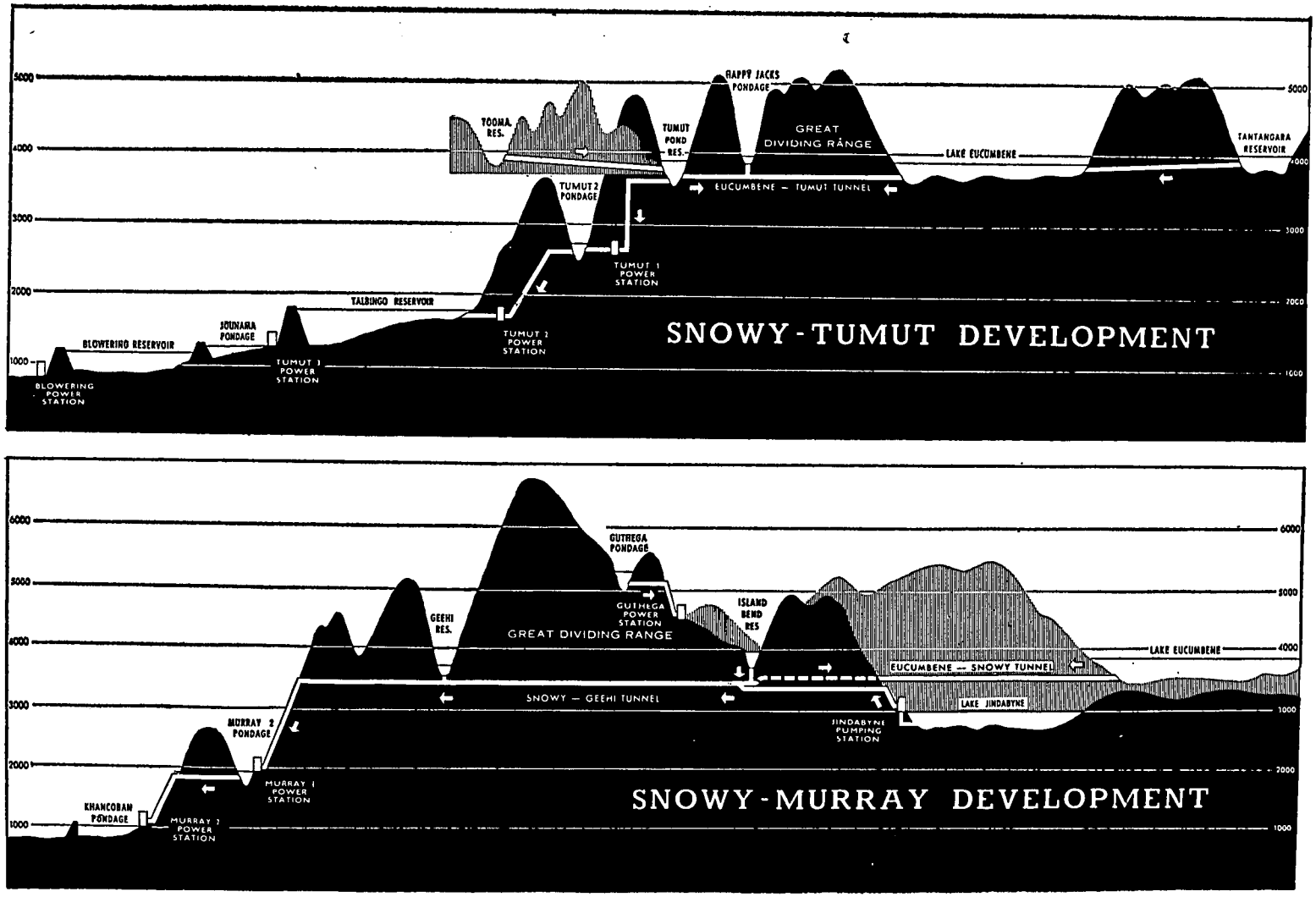

SNOWY MOUNTAINS SCHEME
LEGEND
Roads
Railways
Tunnels
Dams and Reservoirs
Power Stations
Lookouts
Main Watershed
State Boundaries
5 0 5 10
Scale of Miles
TUMUT
CANBERRA
BLOWERING RESERVOIR
Batlow
Talbingo
JOUNAMA PONDAGE
TALBINGO RESERVOIR
Yarrangobilly Caves
TANTANGARA RESERVOIR
A. C. T.
MURRUMBIDGEE
Murrumbidgee River
Tumbarumba
Kiandra
THE
RIVER
Cabramurra
Tooma
Tooma River
TOOMA RESERVOIR
Tumut River
Adaminaby
SNOWY
Bredbo
RIVER
Adaminaby Old Site
GREAT
DIVIDING
RANGE
MOUNTAINS
EUCUMBENE DAM
Eucumbene
LAKE EUCUMBENE
Eucumbene River
HIGHWAY
COOMA 2700'
Khancoban 1200'
N.
S.
W.
MURRAY RIVER
Murray Gorge
Geehi
Bella Vista
Island Bend
LAKE JINDABYNE
COOMA AERODROME
Berridale
Geehi
Smiggin Holes
Jindabyne
MT. KOSCIUSKO 7314'
SNOWY RIVER
VIC.
Thredbo
DEAD HORSE CAP 5190'

PLATE 50

PLATE 51


SNOWY-TUMUT DEVELOPMENT
TOOMA RES.
HAPPY JACKS PONDAGE
GREAT DIVIDING RANGE
TUMUT POND RES.
LAKE EUCUMBENE
TANTANGARA RESERVOIR
EUCUMBENE – TUMUT TUNNEL
TUMUT 2 PONDAGE
TUMUT 1 POWER STATION
TALBINGO RESERVOIR
JOUNAMA PONDAGE
BLOWERING RESERVOIR
TUMUT 2 POWER STATION
TUMUT 3 POWER STATION
BLOWERING POWER STATION
5000
4000
3000
2000
1000
SNOWY-MURRAY DEVELOPMENT
GUTHEGA PONDAGE
GEEHI RES.
GUTHEGA POWER STATION
ISLAND BEND RES
GREAT DIVIDING RANGE
LAKE EUCUMBENE
EUCUMBENE – SNOWY TUNNEL
SNOWY – GEEHI TUNNEL
LAKE JINDABYNE
MURRAY 2 PONDAGE
JINDABYNE PUMPING STATION
MURRAY 1 POWER STATION
KHANCOBAN PONDAGE
MURRAY 2 POWER STATION
6000
5000
4000
3000
2000
1000

the Great Dividing Range into the Swampy Plain River in the catchment of the Upper Murray, and the development of power on the western slopes of the Alps. The main works of the development are as follows.

(*a*) A tunnel from the Snowy River near Island Bend through the Great Dividing Range to Geehi Reservoir on the Geehi River, and two power projects between Geehi Reservoir and the Swampy Plain River near Khancoban. The power stations associated with these two power projects, Murray 1 and Murray 2, have a combined capacity of 1,500,000 kW.

(*b*) A tunnel from a dam on the Snowy River near Island Bend to Eucumbene Dam to carry Snowy water to Lake Eucumbene for storage at times of high river flows. When river flows are lower than average, this stored water is returned towards Island Bend and thence through the Snowy–Geehi Tunnel to Geehi Reservoir and Murray 1 and Murray 2 Power Stations.

(*c*) A dam on the Snowy River near Jindabyne to store the residual flow of the snowy and Eucumbene Rivers downstream from Island Bend and Eucumbene Dams, including the flows of major tributaries, the Crackenback and Mowamba Rivers; and a pumping plant, pipeline and tunnel to lift this water from Jindabyne Reservoir to the Snowy–Geehi Tunnel near Island Bend, where it joins the flow to the Geehi Reservoir for use through Murray 1 and Murray 2 Power Stations.

The power output of this section of the Scheme is increased by the Guthega Project, a subsidiary hydro-electric project on the Upper Snowy River above Island Bend with a generating capacity of 60,000 kW.

Utilisation of power from scheme

The future electric power plants on the mainland of Australia will be predominantly thermal or thermo-nuclear installations, and in an electrical system in which the greater part of the energy is generated in thermal plants it is usually found that the hydro installations operate to the best advantage on peak load. However, the existing New South Wales and Victorian systems include a proportion of relatively old and less efficient installations which, for reasons of fuel economy, are also best used for the production of peak load power. Therefore, in order to utilise the potential of the Snowy Mountains Scheme most effectively, the order of development was arranged so that the early stations operated, initially, somewhat below the peak of the system load, with a progressive change to predominantly peak load operation as construction proceeded and as the load increased in magnitude.

The Snowy Mountains Scheme is situated about midway between the principal load centres of Sydney and Melbourne and is connected to those cities by 330 kV transmission lines. It is, consequently, in a position to take advantage of the diversity in the power requirements of these two load systems, a most important factor in so far as it affects the economy of operation of the supply systems of the two States. Although most of the output from the scheme will go to the States of New South Wales and Victoria, the Commonwealth Government has the right to draw from the scheme its requirements of power and energy for the Australian Capital Territory and for defence purposes. For convenience, the Commonwealth's requirements are drawn from the New South Wales transmission network by an exchange arrangement between the Commonwealth and the Electricity Commission of New South Wales. Electricity over and above that required by the Commonwealth Government is divided between the States of New South Wales and Victoria in the ratio 2:1.

Progress of scheme and future programme

The scheme's first power station, Guthega, of 60,000 kW capacity, came into operation in February 1955. It was followed by Tumut 1, an underground power station with a capacity of 320,000 kW, in 1959, and by the 280,000 kW Tumut 2 underground Power Station in 1962. Eucumbene Dam, which provides the major regulating storage for the scheme, was completed in May 1958. Tumut Pond Dam, completed in September 1958, provides the balancing storage for the power stations of the Upper Tumut Works. The first trans-mountain diversion of water from Lake Eucumbene to the Tumut River at Tumut Pond was made possible when the 14-mile Eucumbene–Tumut Tunnel was completed in June 1959. The 10½-mile Murrumbidgee–Eucumbene Tunnel and the 9-mile Tooma–Tumut Tunnel came into operation early in 1961. Following the completion of the Upper Tumut Works, construction activity was concentrated on the Snowy–Murray Development. The first unit of this development, the Eucumbene–Snowy project which comprises Island Bend Dam and the 15-mile Eucumbene–Snowy Tunnel, commenced diverting Snowy River water to storage in Lake Eucumbene in August 1965. Completion of a 9-mile trans-mountain Snowy–Geehi Tunnel, the 7½-mile Murray 1 Pressure Tunnel, the first of the 1-mile long Pressure Pipelines, and the first two units of the 950,000 kW Murray 1 Power Station in April 1966 allowed the first diversion of the water from the Snowy River to the Murray River in the west. All of the ten turbo-generators were brought into commercial operation with the opening of the Murray 1 Project in July 1967.

Khancoban Dam, designed to regulate power station releases before their discharge into the Murray River, was completed in February 1966. The Murray 2 Project in the base of the open cut excavated in the bank of Khancoban Reservoir downstream of Murray 1 Project was completed in 1969. The four units of Murray 2 Power Station totalling 550,000 kW came into commercial operation in October 1969. The total installed capacity of the scheme has now reached 2,160,000 kW.

Construction is also proceeding on the Jindabyne Project. The earth and rockfill dam was completed in September 1967, and the pumping station and Jindabyne-Island Bend Tunnel came into service in February 1969.

Blowering Dam on the Tumut River came into service in May 1968, and the 80,000 kW Blowering Power Station is expected to begin commercial operation in October 1970 when the stored water in the Blowering Reservoir is to be released for the irrigation season downstream on the Murrumbidgee Irrigation Areas.

For the Tumut 3 Project the construction of Jounama Dam was completed in 1968 so that the storage of water in Blowering Dam could commence. Work is under way on the remaining sections of the Tumut 3 Project, and the six units in the power station are scheduled to be brought into service progressively from 1972 to 1974.

STATES AND TERRITORIES

New South Wales

In Year Book No. 39 an account was given in some detail of the origin and development of electricity generation and distribution in New South Wales. At present the following three main Acts govern electricity supply in New South Wales.

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.

The Electricity Development Act, 1945–1968, which established the Electricity Authority of New South Wales as the body responsible for the co-ordination of electricity supply throughout the State.

The Electricity Commission Act, 1950–1965, 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.

Electricity Commission of New South Wales and electricity supply authorities

The main function of the Commission is the generation and transmission of electricity, which it sells in bulk to distributing authorities (mainly local government bodies) throughout a large part of the State, to the Government railways and to certain large industrial consumers. As the major generating authority, it is also responsible for the development of new power sources except in the Snowy Mountains region.

The retail sale of electricity to the public is, in general, carried out by separate electricity supply authorities. At 30 June 1969 there were 41 retail supply authorities throughout the State, comprising 34 electricity county councils (consisting of groups of shire and/or municipal councils), 2 city and 2 municipal councils, 1 shire council, and 2 private franchise holders. In addition to the Electricity Commission, 2 coal companies supply electricity in bulk to retail supplying authorities. Most of the small power stations which had operated in many country centres have closed down as the main transmission network has been extended.

In recent years, most electricity distribution areas have been consolidated on a district basis. Generally, these consolidations have taken the form of a county district consisting of a number of neighbouring shire and municipal and city areas grouped for electricity supply purposes, and administered by a county council comprising representatives elected by the constituent councils. Of the 225 cities, municipalities and shires in New South Wales, 216 are included in one or other of the thirty-four electricity county districts. The majority of these county districts have been constituted since 1945. The largest of the county councils is the Sydney County Council, which at 30 June 1969 was supplying 588,776 consumers in the Sydney metropolitan area.

The Electricity Authority of New South Wales

The Electricity Authority of New South Wales was constituted under the Electricity Development Act, 1945 and is responsible to the Minister for Local Government. The Act confers broad powers on the Authority to co-ordinate and develop the public electricity supply industry. The functions of the Authority include the promotion of the use of electricity and especially its use for industrial and manufacturing purposes and for primary production. Technical advice is given to retail electricity

supply authorities on various aspects of their activities such as the framing of retail electricity tariffs, public lighting and standardisation of materials and equipment. The Authority acts in an advisory capacity to the Minister for Local Government on electricity distribution matters generally, and may make recommendations concerning the organisation of distribution, the amendment of the law relating to the generation, transmission, distribution and supply of electricity, or on any other matters affecting the electricity distribution industry.

The Authority administers the Rural Electricity Subsidy Scheme under which the rural electrical development of the State has now been virtually completed where the extension of supply is economically feasible, *see* page 956.

The Electricity Development Act contains provisions for the making of regulations relating to most aspects of electrical safety. Regulations now in force cover such matters as consumers' installations, licensing of electricians and electrical contractors, approval of electrical articles, safety of linesmen, and overhead line construction and maintenance. In addition, a number of aspects not governed by legislation are covered by codes of practice or recommended procedures.

In 1964 the Traffic Route Lighting Subsidy Scheme administered by the Authority was introduced. The Scheme has the objective of reducing the incidence of night road accidents on traffic routes traversing built-up areas by the installation of improved lighting. The scheme provides for financial assistance to councils towards the cost of traffic route lighting installations conforming to the appropriate street lighting code of the Standards Association of Australia, which has been adopted by the Authority as the basis of the scheme. To 30 June 1969 subsidy has been approved in respect of lighting on some 358 miles of traffic routes throughout the State.

Generation and transmission

Of the State's electrical power requirements during the year ended 30 June 1969, 88.1 per cent was generated by coal fired power stations in New South Wales, 0.4 per cent by internal combustion plants, 7.8 per cent by hydro-electric stations (including 6.8 per cent obtained direct from the Snowy Mountains Scheme). Interstate imports accounted for 3.7 per cent of the State's electricity requirements. Whilst the supply of power from the Snowy Mountains Scheme will increase with the expansion of the Scheme, it is expected that coal fired steam power stations (and possible atomic power stations in the future) will continued to supply the greater part of the State's power needs.

Major generating stations. At 30 June 1969 the major power stations of the State system of the Electricity Commission of New South Wales and their effective capacities were as follows: *Steam*—Munmorah (Tuggerah Lakes), 1,050,000 kW; Vales Point (Lake Macquarie), 875,000 kW; Bunnerong (Sydney), 375,000 kW; Wangi (Lake Macquarie), 330,000 kW; Tallawarra (Lake Illawarra), 320,000 kW; Wallerawang (near Lithgow), 240,000 kW; Pyrmont (Sydney), 200,000 kW; White Bay (Sydney), 172,000 kW; Balmain (Sydney), 107,000 kW; Port Kembla, 60,000 kW; Zarra Street (Newcastle), 42,000 kW; Muswellbrook, 30,000 kW; Tamworth, 27,000 kW; Lithgow, 20,000 kW; Maitland, 20,000 kW; Penrith, 20,000 kW; Liverpool, 20,000 kW; *Hydro*—Hume (near Albury), 50,000 kW; Warragamba (near Penrith), 50,000 kW; Burrinjuck (near Yass), 20,000 kW. There were also various other steam, hydro and internal combustion stations aggregating 35,000 kW. The total effective capacity of the Electricity Commission's system was 4,063,000 kW. The greater part of the Commission's generating plant is concentrated within a hundred mile radius of Sydney—the largest stations outside this area being located at Hume, Muswellbrook and Tamworth.

Major transmission network. The retailing of electricity to 97 per cent of the population of New South Wales is in the hands of local distributing authorities, which obtain electricity in bulk from the Commission's major State network. This network of 330 kV, 132 kV, 66 kV and some 33 kV and 22 kV transmission lines, links the Commission's power stations with the load centres throughout the eastern portions of the State, extending geographically up to 400 miles inland.

At 30 June 1969 there were in service 1,097 route miles of 330 kV (including 64 miles operating for the time being at 132 kV) and 2,826 miles of 132 kV transmission lines (including 50 miles operating for the time being at 66 kV or lower). There were also in service 2,584 miles of transmission line of 66 kV and lower voltages, and 83 miles of underground cable. The installed transformer capacity at the Commission's 135 sub-stations was 14,957,000 kVA'

Separate systems and total State installed capacity. Several small plants which supply isolated towns and villages have not yet been interconnected with the main network. Some local government bodies have undertaken the development of independent power stations. Of these, the more important are: the Northern Rivers County Council, which has constructed a steam power station at Koolkhan (near Grafton) with an installed capacity of 28,750 kW, and the North-West County Council, which has established a 15,000 kW steam power station on the Ashford coalfield. The aggregate effective capacity for the whole of the New South Wales systems and isolated plants was 4,165,540 kW at 30 June 1969 and the number of ultimate consumers at this date was 1,518,177.

Future development

The major new thermal stations already built and those now being developed on the coalfields will become the main base load supply sources for the State. Munmorah, located between Lakes Munmorah and Budgewoi, Vales Point and Wangi, on Lake Macquarie, Wallerawang, near Lithgow, and Tallawarra, on Lake Illawarra, have been completed.

The first 500,000 kW generating unit of the Liddell Power Station in the Hunter Valley is scheduled for commissioning in 1971 and the second, third and fourth units in 1972, 1973 and 1974. With a designed capacity of 2,000,000 kW Liddell is the biggest thermal power station yet planned for Australia.

Future projects include the installation of an additional 500,000 kW unit at Wallerawang, scheduled for commissioning in 1975, and two 660,000 kW units at Vales Point, expected to come into operation in 1977.

The development of the 330 kV main system is continuing. New work in hand includes the provision of 330 kV transmission from Liddell direct to Sydney and the construction of major 330 kV transmission centres at Tamworth and Newcastle and later at Armidale. Plans to augment the transmission system during the next five years provide for the construction of 1,200 route miles of 330 kV lines, 1,200 miles of 132 kV overhead lines, and 17 new sub-stations.

Hydro-electricity

The greater part of the hydro-electric potential of New South Wales is concentrated in the Snowy Mountains area (*see* Snowy Mountains Hydro-electric Scheme, page 950). Apart from this area, major hydro-electric stations are in operation at the Warragamba Dam (50,000 kW), Hume Dam (50,000 kW), Burrinjuck Dam (20,000 kW), and Keepit Dam (6,000 kW). The output of Warragamba Power Station depends upon the availability of water surplus to the requirements of the Sydney metropolitan area, and the output of the other stations on the release of water for irrigation. There are, in addition, four smaller hydro-electric installations in operation in various parts of the State.

Rural electrification

When the Electricity Authority of New South Wales was constituted in 1946 less than one-quarter of New South Wales farms within reasonable reach of public electricity supply systems were being served with electricity. Under a subsidy scheme approved in August 1946, local electricity suppliers receive subsidies from the Electricity Authority towards the cost of new rural lines. The amount of subsidy is based on the estimated cost of the proposed extension and the number of consumers able to be served by the new lines. The scheme was designed to encourage local electricity supply authorities to construct the more economic extensions first by fixing a limit to the cost for which suppliers could be subsidised. Originally this limit was $500 per consumer when averaged over the cost of the whole extension, but the limit was raised to $800 in December 1953. Some subsidy was paid on higher cost extensions, but the excess over an average of $800 was not subsidised.

To assist supply authorities in extending supply to less populated, and thus high-cost, areas of the State the subsidy scheme was extended from May 1959 to provide for payment of increased subsidy in respect of extensions where the average capital cost per consumer lies within the range of $1,200–$1,600.

Between August 1946 and June 1969, applications for subsidy had been made by electricity suppliers to the Authority covering rural extensions costing $84.6 million to give supply to some 61,215 farming properties and 36,329 other rural consumers and involving 60,326 miles of line. The greater part of this work had been completed at 30 June 1969. At this date the Authority was committed to the payment of $35,129,258 in subsidies, of which $23,145,374 had been paid.

Under a special scheme of assistance the Electricity Commission makes payments ($1,200,000 per annum from 1967–68 to 1971–72) to offset part of the net liability of local supply authorities in respect of rural electrification.

Victoria

In 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 those 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.

State Electricity Commission of Victoria

Constituted by the *Electricity Commissioners Act* 1918, the State Electricity Commission is a semi-governmental authority administered since 1921 by a full-time Chairman and three part-time

Commissioners. The principal duty of the Commission is to co-ordinate and extend on an economic basis the supply of electricity throughout Victoria. For this purpose it is vested with power to erect, own and operate power stations and other electrical plant and installations, supply electricity retail to individual consumers or in bulk to any corporation or public institution, acquire and operate electricity undertakings, develop, own and operate brown coal open cuts and briquetting works, and develop the State's hydro-electric resources. From its own revenues, which it controls, the Commission must meet all expenditure in the operation of its power, fuel and subsidiary undertakings, provide for the statutory payment of 3 per cent of its revenue to State Consolidated Revenue, and meet depreciation and all other charges on capital funds.

The Commission is the controlling authority for all electrical undertakings in Victoria. It is responsible for the registration of electrical contractors, the licensing of electrical mechanics, the control of installation methods and material, and the testing and approval of electrical equipment and appliances. Incidental to its main operations, the Commission owns and operates the tramway systems in Ballarat and Bendigo.

Since it began operating in 1919 the State Electricity Commission has expanded and co-ordinated the production and supply of electricity on a State wide basis to the point where its system now generates almost all the electricity produced in Victoria and serves 99 per cent of the population. Victoria's electricity system is based on the utilisation of the extensive brown coal resources of the Latrobe Valley in Gippsland.

Output of brown coal in 1968–69 from the Commission's three open cuts at Yallourn, Morwell and Yallourn North totalled 22,466,000 tons, of which 18,047,000 tons were used in the Commission's power stations. A further 3,998,000 tons of brown coal were used to manufacture 1,471,000 tons of briquettes, of which 296,000 tons were burnt in power stations. The only other fuels used in power generation were relatively small quantities of purchased black coal (11,000 tons) and oil (25,000 tons).

Generation in thermal stations is supplemented by energy from the Commission's hydro stations in the mountainous north-east of the State, and by hydro entitlements from the Snowy Mountains Scheme (one-third of the output after provision of the Commonwealth's needs) and Hume Power Station (half of the output).

Electricity Supply

At 30 June 1969, the number of ultimate consumers in Victoria was 1,211,000, all served by the Commission except the extreme eastern settlements of Mallacoota (local generation) and Berdoc (supplied from an adjoining area of New South Wales).

The Commission sells electricity retail in all Victorian supply areas except for eleven metropolitan municipalities. These municipalities, retailing electricity under franchises granted before the Commission was established, take bulk supply from the Commission. Bulk supply is also provided to several New South Wales municipalities and irrigation settlements bordering the River Murray.

The Commission's retail consumers numbered over 981,000 at 30 June 1969. Of these some 820,000 were domestic, 73,000 industrial and 87,000 commercial. Retail supply is administered through the metropolitan branch and ten extra-metropolitan branches with headquarters located at Geelong, Dandenong, Traralgon, Mildura, Castlemaine, Ballarat, Benalla, Bendigo, Colac and Horsham. At 30 June 1969, there were branch and district supply offices in Melbourne and 100 other cities and towns in Victoria.

Complete electrification of the State has virtually been achieved. By 30 June 1969, over one million homes and nearly 73,000 farms were supplied with electricity. Fewer than 3,000 homes and 1,250 farms in remote and isolated areas are now out of reach of public supply mains.

Electricity production, transmission and distribution

Electricity generated in the State system or purchased by it totalled 12,868 million kWh in 1968–69, or more than 99 per cent of all Victoria's electricity for public supply. The system comprises a series of thermal and hydro-electric power stations. Inclusive of generator capacity both within the State and available to the Victorian system from outside the State, the total installed generator capacity at 30 June 1969 was 3,392,000 kW. Power stations are interconnected and feed electricity into a common pool for general supply. The major power station in the interconnected system is the Hazelwood brown coal burning power station near Morwell, which alone generates over 45 per cent of Victoria's electricity. Hazelwood now has seven of its planned eight 200,000 kW generating sets in service. Other power stations in the interconnected system comprise two further base load brown coal burning power stations, Morwell and Yallourn; steam stations in Melbourne (Newport, Richmond and Spencer Street), Geelong and Ballarat, and also at Red Cliffs, which has, in addition, some internal combustion plant; and hydro-electric stations at Kiewa, at Eildon, on the Rubicon and Royston Rivers near Eildon, and at Cairn Curran. All generators for public supply within Victoria

are Commission-owned, except Spencer Street Power Station, which remains the property of the Melbourne City Council, although operated as a unit in the interconnected system, and a small generator at Mallacoota. The Victorian system is linked with the Snowy Mountains Scheme by a 330 kV transmission line, which also allows the interchange of energy between New South Wales and Victoria. The hydro station at Hume Dam on the River Murray is also linked with the Victorian interconnected system. Output and operating costs of this power station, owned by the Electricity Commission of New South Wales, are shared equally by the Electricity Commissions of Victoria and New South Wales.

The electrical transmission and distribution system in the State supply network at 30 June 1969 comprised nearly 59,000 miles of power-lines, 24 terminal receiving stations, 96 main transmission sub-stations, and more than 59,000 distribution sub-stations. Main transmission is by 500 kV, 330 kV, 220 kV and 66 kV power lines which supply the principal distribution centres and also provide interconnection between the power stations. The 500 kV, 330 kV and 220 kV systems total nearly 1,700 route miles.

Future development

Major works in progress are the erection of two large power stations (Hazelwood and Yallourn 'W') burning brown coal on site in the Latrobe Valley.

Hazelwood Power Station, which is nearly completed, is the largest project yet undertaken by the Commission and is designed to have a capacity of 1,600,000 kW in 1971. The first of Hazelwood's eight 200,000 kW turbo-generators was commissioned in October 1964 and another six have been installed at approximately yearly intervals. The last generating set will be in service early in 1971. Power generated at Hazelwood Power Station is transmitted at high voltage to Melbourne metropolitan terminal stations for distribution through the State supply network.

Yallourn 'W' Power Station is being built about half a mile west of the present Yallourn Power Station. It will have two 350,000 kW turbo-generators, the first to be in service in 1972 and the second in 1973.

When these projects are in service the State's power resources, including Victoria's share of the output of the Snowy Mountains Scheme, will have increased to 4,815,000 kW, 45 per cent above the capacity at June 1969.

Queensland

In Year Book No. 39 an account is given of the growth of electricity generation in Queensland, with particular reference to south-eastern Queensland, and of the events leading up to the establishment in 1937 of the State Electricity Commission of Queensland. In Year Book No. 53 an account is given of the post-war development and organisation of the electricity supply in Queensland.

Electricity supply in Queensland is governed by the following Acts which are administered by the Commission.

'*The State Electricity Commission Acts*, 1937 *to* 1965.' These Acts constituted the Commission and define its powers and duties.

'*The Electric Light and Power Acts*, 1896 *to* 1967.' These Acts relate to the constitution of electric authorities, except the Southern Electric Authority and the Northern Electric Authority, and define their powers and duties and the conditions under which electricity is to be supplied and used.

'*The Regional Electric Authorities Acts*, 1945 *to* 1964.' These Acts provide for the constitution of Regional Electricity Boards representative of the Commission and the Local Authorities within each region, and define their powers and responsibilities.

'*The Southern Electric Authority of Queensland Acts*, 1952 *to* 1964.' These Acts established the Southern Electric Authority and define the powers and responsibilities of the Authority.

'*The Northern Electric Authority of Queensland Acts*, 1963 *to* 1964.' These Acts established the Northern Electric Authority. They also define its powers and responsibilities.

'*The Electrical Workers and Contractors Acts*, 1962 *to* 1968.' These Acts provide for the certification of electrical workers and for the licensing of electrical contractors.

State Electricity Commission of Queensland

The Commission commenced to function in January 1938. The Commission is the statutory authority concerned, *inter alia*, with the administration of electricity supply legislation, the general control, organisation and efficient development of the electricity supply industry in Queensland, the forward planning of such development, the control of electricity charges, the administration of regulations and rules relating to safety, the raising of capital, the provision of engineering and

consulting services, the promotion of the use of electricity, particularly in manufacturing and rural industries, and the fixing of standards. In addition, it is an authority to which consumers may appeal on matters in dispute between them and their electric authorities. The Commission is also empowered to own directly and operate generating stations and transmission lines and to sell electricity in bulk, but up to the present it has not been found necessary or desirable to implement this power.

Organisation

Regional electrification, with centralised generation and main transmission, is the predominant feature of the organisation of the electricity supply industry in Queensland. The more populous eastern part of the State is served by three major networks.

The southern network embraces the areas of supply of the Southern Electric Authority, the Brisbane City Council, the Wide Bay-Burnett Regional Electricity Board, and the Dalby Town Council. Generation and main transmission in this area are the responsibility of the Southern Electric Authority, which sells energy in bulk to the other three Authorities. The Wide Bay-Burnett Board also operates its own base load power station at Howard. The Southern Electric Authority is also responsible for the distribution of electricity to a large rural area outside metropolitan Brisbane.

The central network is within the area of supply of the Capricornia Regional Electricity Board, which is responsible for the generation, main transmission and distribution of electricity.

The northern network covers the areas of supply of the Cairns, Townsville, and Mackay Regional Electricity Boards. Generation and main transmission are the responsibility of the Northern Electricity Authority, and electricity is purchased in bulk for distribution by the three Regional Electricity Boards. In addition, the Cairns Regional Electricity Board operates small internal combustion generating stations at certain isolated centres in its area, and the Townsville Regional Electricity Board supplies the western area of its region by means of a distribution system based on an internal combustion station at Hughenden.

At present there is no interconnection between these three main networks, but work has started on the construction of 275kV transmission lines between central and southern Queensland, to link the two supply systems. West of the three main networks the form of organisation which has been adopted is determined by the stage of electrical development which has been reached. Immediately west of the Capricornia region the Central Western Regional Electricity Board operates with generation centralised at internal combustion stations at Longreach and Barcaldine. Other smaller regions of electricity supply are centred on Roma and Mount Isa. In addition, parts of southern Queensland are supplied by the Tenterfield Municipal Council and the North West County Council of New South Wales. In the remaining parts of Western Queensland there are a number of isolated electricity undertakings operated by Shire Councils.

The organisation of the industry in Queensland is moving progressively towards a greater integration of generating authorities so that the production of electricity can be centred to an increasing extent on larger and more efficient power stations.

Electricity generation, transmission and distribution

Electricity generated in the State is based primarily on black coal, 89.3 per cent of the total production during 1968–69 being derived from this fuel. Hydro-electric stations, located mainly in North Queensland, provided 9.5 per cent, and the balance of the production was provided from internal combustion and gas turbine stations. The gas turbine stations are located at Rockhampton, Swanbank and Middle Ridge, near Toowoomba and use fuel oil as their primary energy source. Most of the internal combustion stations use oil as fuel but the power station at Roma uses locally produced natural gas and crude oil. Electricity generated in Queensland in power stations during 1968–69 totalled 5,410 million kWh. A further 23 million units were purchased in bulk from other producers of electricity for re-distribution to consumers.

At 30 June 1969 the total generating capacity of all Queensland power stations was 1,634,858 kW comprising 1,405,750 kW of steam plant, 135,208 kW of hydro-electric plant, 38,900 kW of internal combustion plant and 55,000 kW gas turbine plant. The southern electricity network is served by the following power stations: Bulimba 'A' (92,500 kW), Bulimba 'B' (180,000 kW), New Farm (75,000 kW), Tennyson 'A' (120,000 kW), Tennyson 'B' (120,000 kW), Swanbank 'A' (396,000 kW), and Howard (37,500 kW) together with a gas turbine station—Swanbank 'C' (30,000 kW). The central network is served by power stations at Rockhampton (52,500 kW steam and 25,000 kW gas turbine) and at Callide (120,000 kW). In the northern electricity network the principal power stations are at Townsville (37,500 kW), Kareeya (72,000 kW), Barron Gorge (60,000 kW) and Collinsville (60,000 kW). Most of the power stations in the major eastern supply networks of the State are thermal using coal as their primary energy source. The State's two large hydro-electric power stations are in the Cairns region in North Queensland, at Kareeya (72,000 kW) and Barron Gorge (60,000 kW).

Peak load gas turbine stations have been built at Rockhampton (25,000 kW) and Swanbank 'C' (30,000 kW) and the State's largest gas turbine station to date, at Middle Ridge near Toowoomba (60,000 kW) will be commissioned during 1970.

The electrical transmission and distribution systems within the State comprised 44,802 circuit miles of electric lines at 30 June 1969. The main transmission voltages are 132 kV, 110 kV, 66 kV and in certain areas 33 kV. Work has started on the construction of 275 kV transmission lines in southern Queensland and also between Gladstone and Brisbane, the first time transmission lines of such high voltage have been built in Queensland. The electricity supply industry's extensive rural electrification programme has been continued using the single wire earth return system.

At 30 June 1969 the total number of electricity consumers was 547,611 of whom 214,552 were in the Brisbane metropolitan area.

Future development

Major development of the State's generating capacity will be concentrated on the construction of two major power stations, at Gladstone (1,100,000 kW) and Swanbank 'B' (480,000 kW) the completion of Collinsville 'A' (120,000 kW) and the construction of extensions to Collinsville, known as Collinsville 'B' (120,000 kW). The first of Swanbank 'B's' four 120,000 kW generating sets will be commissioned in 1970 and the station is expected to become fully operative in 1973. The Gladstone power station will comprise four 275,000 kW generating sets, the first of which is expected to be commissioned by 1974. The output of these two power stations will help to meet increasing demands for power over the planned southern and central interconnected systems.

In North Queensland the fourth and final 30,000 kW generating set for Collinsville 'A' is scheduled for commissioning in 1971. This will be followed by a major extension programme, known as Collinsville 'B', which will involve the commissioning of two 60,000 kW sets, and will give Collinsville a total generating capacity of 240,000 kW. The two sets are scheduled for commissioning in 1974 and 1977 respectively.

Investigations are already in hand for the planning of another major power station to follow the Gladstone project, as well as the economic feasibility of further interconnection of the State's electricity supply systems.

South Australia

A general historical survey concerning the electricity supply industry in South Australia is given in Year Book No. 39, page 1186. The survey traces the development of the industry from its formation in South Australia in 1895 until the establishment of the South Australian Electricity Commission in 1943.

Electricity Trust of South Australia

In 1946 the assets of the Adelaide Electric Supply Co. Ltd were transferred to a newly formed public authority, the Electricity Trust of South Australia, which became responsible for unification and co-ordination of the major portion of the State's electricity supply and which took over the powers previously vested in the South Australian Electricity Commission. In addition to the powers specified in the Adelaide Electric Supply Company's Acts, 1897–1931, the Trust may supply electricity direct to consumers within a district or municipality with the approval of the local authority, and by agreement with other organisations which generate or supply electricity, arrange to inter-connect the mains of the Trust with those of other organisations, and give or receive supplies of electricity in bulk.

Capacity and production

Of the total installed capacity in South Australia at 30 June 1969, the Electricity Trust operated plant with a capacity of 961,000 kW, and is the most important authority supplying electricity in the State. There were approximately 418,000 ultimate consumers of electricity in the State, of whom 401,000 were supplied directly and approximately 11,700 indirectly (i.e. through bulk supply) by the Trust. Its major steam stations are Osborne 'B' (240,000 kW), Port Augusta Playford 'A' (90,000 kW) and Playford 'B' (240,000 kW), and Torrens Island (360,000 kW).

The Trust operates two smaller power stations, The Mt Gambier station has an installed capacity of 21,800 kW and burns either wood waste or fuel oil. The other station at Port Lincoln has a 5,000 kW steam and a 4,600 kW diesel plant. Both locations are connected with the Trust's interconnected system with 132 kV lines.

No hydro-electric potential exists in South Australia. Steam generating units comprise 98 per cent of installed capacity and the balance is internal combustion equipment.

Leigh Creek and other new capacity

Fairly extensive deposits of low grade sub-bituminous coal are obtained at Leigh Creek, about 360 miles north of Adelaide. Under the Electricity Trust of South Australia 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 30 June 1969, 2,142,538 tons of coal were produced, practically all of which was used by the electricity undertaking at the Port Augusta Playford Power Stations, which use Leigh Creek coal exclusively.

A power station is being constructed on Torrens Island near Adelaide consisting of four 120,000 kW turbo-alternators and associated boilers modified to use natural gas or oil and will be completed by 1971. The No. 3 unit consisting of 120,000 kW turbo-alternator and associated boiler was placed on load for the first time in April 1969.

Western Australia

For information on the early history of electricity supply in the metropolitan area, *see* Year Book No. 39, page 1189.

State Electricity Commission of Western Australia

The State Electricity Commission of Western Australia was established by the *State Electricity Commission Act, 1945*. The Commission, as at present constituted, consists of nine members and is empowered to co-ordinate all power undertakings in the State and to encourage and promote the use of electricity and other power.

General pattern of electricity supply

The State Electricity Commission gives central power station supply to the metropolitan area, an area of approximately 30,000 square miles in the South-West and Great Southern Areas, and an area extending eastward from Perth to Koolyanobbing. The policy of extending power supplies to rural holdings is continuing and at 30 June 1969 some 10,984 such consumers were connected. A scheme known as the Northern Areas State Power Scheme is also being developed, and a depot has been established in the Geraldton area where the Commission purchases power in bulk to supply districts north to Northampton and south to Dongara. It also supplies Port Hedland with power which is generated by a diesel station situated in the town.

In the other areas of the State, towns are supplied by the local authority or by a concessionaire operating under an agreement with the local authority and the Commission. Power stations operated under these conditions are exclusively diesel of varying sizes.

In Kalgoorlie the large goldmines generate their own power requirements. The Kalgoorlie Town Council operates a 50-cycle diesel station to supply A.C. consumers in Kalgoorlie and Boulder. The D.C. stations of the Kalgoorlie and Boulder Town Councils will continue to operate for some time at least.

The total number of consumers at 30 June 1969 was 249,336, of whom 229,861 were supplied by the Commission.

The Commission has developed its system to provide for the rapid expansion of industry and housing, and generating plant has increased almost ten-fold in the past twenty-three years. The four major power stations in the system are interconnected with the South-West Power Station at Collie, enabling the most economical units to be used as a base load station. Continuous development of the transmission and distribution system is also being undertaken to keep pace with the growth in consumer demand, which is being maintained at a high level. The activities of the interconnected system for the year 1968–69 were as follows: plant capacity, 529,500 kW; maximum load, 475,000 kW; units generated, 1,902 million kWh; fuel used per unit (kWh) generated, 1.36 lb; coal used, 912,782 tons.

New projects

Contracts have been let for four 120,000 kW oil-fired units for a new station being built at Kwinana. It is expected that these units will be commissioned in 1970. 1971, 1972 and 1973.

Tasmania

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. Another factor contributing to the low cost is that rainfall is distributed fairly evenly throughout the year with comparatively small yearly variations. The abundant and comparatively cheap supplies of electricity and other natural resources have attracted to Tasmania a number of important secondary industries, including large electro-chemical and metallurgical works with high load factor (in consequence of which the system load factor is also very high—70 per cent), for which energy costs constitute a large proportion of the total cost of production. The continuous power demand of these organisations when plant is in full operation aggregates 390,000 kW. For information on hydro-electric development in Tasmania prior to the establishment of the Hydro-Electric Commission in 1930, *see* Year Book No. 39, pages 1192–3.

Hydro-Electric Commission

In 1929 the Government passed the *Hydro-Electric Commission Act* 1929, which established the Hydro-Electric Commission and vested in the Commission, with some minor exceptions, the right to use the waters of the State of Tasmania, and authorised 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.

The total installed capacity of alternators in the various power stations operating now, under construction, or projected is as follows.

Power stations	*Water system*	*Date of entry into system(a)*	*kW*
Tarraleah	Derwent	1938	90,000
Waddamana 'B'	Great Lake	1944	48,000
Butlers Gorge	Derwent	1951	12,200
Tungatinah	Nive/Ouse/Little Pine	1953	125,000
Trevallyn	South Esk(*b*)	1955	80,000
Lake Echo	Little Pine/Ouse	1956	32,400
Wayatinah	Derwent	1957	38,250
Liapootah	Derwent	1960	83,700
Catagunya	Derwent	1962	48,000
Poatina	Great Lake	1964	250,000
Tods Corner	Arthurs Lake	1966	1,600
Meadowbank	Derwent	1967	40,000
Cluny	Derwent	1967	17,000
Repulse	Derwent	1968	28,000
Rowallan	Mersey-Forth	1968	10,450
Lemonthyme	Mersey-Forth	1969	51,000
Devils Gate	Mersey-Forth	1969	60,000
Wilmot	Mersey-Forth	1970	30,600
Bell Bay Thermal	..	1970	120,000
Cethana	Mersey-Forth	1970	85,000
Paloona	Mersey-Forth	1971	28,000
Fisher	Mersey-Forth	1971	43,200
Gordon River, Stage 1	Gordon/Serpentine/Huon	1975	240,000

(*a*) Actual till 1969; planned dates for subsequent years. (*b*) Discharge from Poatina enters South Esk via tributaries.

The number of ultimate consumers at 30 June 1969 was 143,551.

New capacity

The Hydro-Electric Commission is engaged on a construction programme comprising the Mersey-Forth Power Development, Gordon River Power Development, Stage 1.

The Mersey-Forth Power Development is scheduled to be completed by 1971. The essence of this development is the diversion of the flows of the Mersey and Wilmot Rivers and tributaries into the Forth River and the construction of Forth River dams. These diverted flows will be used for power generation at seven distinct power stations. The Mersey-Forth Project will add a total of 308,250 kW to the system. The first stage of the Gordon River Power Development involves the construction of a dam and a power station with a proposed instalment of 240,000 kW capacity with provision for an increase to 320,000 kW. An oil-fired thermal station with a single 120,000 kW generator was completed at Bell Bay on the River Tamar in 1970.

The Commission is conducting extensive surveys and investigation of other schemes with a view to further construction after the completion of the present programme. Investigations are continuing into the very considerable resources as yet untouched, principally in the west and south-west of the State, and it is estimated that the potential which can be developed economically should ultimately harness 3,000,000 kW to the system.

Statistical summary

The following table shows statistics for each State and Territory separately and for Australia for the year 1967–68. Statistics of the electricity supply industry for the years 1963–64 to 1967–68 are given in the chapter Manufacturing Industry. Particulars of the Snowy Mountains scheme are included under New South Wales in the following table.

CENTRAL ELECTRIC STATIONS: STATES AND TERRITORIES, 1967-68

		N.S.W.	Vic.	Qld	S.A.	W.A.	Tas.	N.T.	A.C.T.	Aust.
Generating stations—										
Government	No.	28	12	..	13	12	19	5	..	89
Local authority	„	8	3	42	7	35	..	..	..	95
Companies	„	14	1	1	8	42	2	..	..	68
Total stations	„	*50*	*16*	*43*	*28*	*89*	*21*	*5*	..	*252*
Installed capacity of generators—										
Steam	'000 kW	3,768	2,292	1,220	797	514	10	47	..	8,647
Hydro	„	1,751	333	135	..	2	915	..	..	3,136
Internal combustion	„	81	20	(*a*)52	14	158	34	11	..	370
Total capacity	„	*5,600*	*2,644*	*1,407*	*811*	*675*	*958*	*58*	..	*12,153*
Persons employed(*b*)	No.	4,141	3,654	1,893	(*g*)	1,255	(*g*)	105	..	12,999
Value of output(*c*)	$'000	153,078	101,380	55,347	(*g*)	31,040	(*g*)	2,531	..	386,132
Value of production(*d*)	„	112,955	72,259	28,514	(*g*)	18,231	(*g*)	1,320	..	263,018
Electricity generated(*e*)	million kWh	18,043	11,419	5,189	3,890	2,216	3,773	122	(*h*)	44,663
Ultimate consumers(*f*)	No.	1,470,761	1,173,110	528,000	408,000	238,252	139,886	8,556	33,286	3,999,851

(*a*) Including gas turbine. (*b*) Average employment in generating stations over whole year, including working proprietors. (*c*) Value, at generating station, of electricity produced plus certain earnings. (*d*) Value added in the process of generation. (*e*) Total generated including that generated by factories for their own use. The generation of electricity within each State takes no account of interchange of electricity between States. Furthermore, Victorian details exclude entitlements to generation from Hume Power Station and the Snowy Mountains Hydro-electric Scheme. (*f*) Approximate figures supplied by the electricity authority in each State. An 'ultimate consumer' is a person, business, undertaking, etc., that has contracted to receive electric power from a public or private organisation supplying this service. The number of ultimate consumers is not identical with the number of persons served with electricity because one ultimate consumer may represent three or four persons, e.g. in a household. (*g*) Not available for publication; included in the total for Australia. (*h*) Not available. Excluded from Australian total.

Commonwealth Territories

The electricity supply undertakings at Darwin, Katherine, Tennant Creek, and Alice Springs in the Northern Territory are operated by the Commonwealth Government.

Australian Capital Territory

The supply authority is the A.C.T. Electricity Authority, which took over the functions of the Canberra Electric Supply Branch, Department of the Interior, on 1 July 1963. Supply was first made available in Canberra during 1915 and was met from local steam plant. Connection to the New South Wales interconnected system was effected in 1929, and all requirements are now taken from this system. Locally owned plant consists of 4,000 kW of diesel alternators which are retained as a standby for essential supplies. The total number of ultimate consumers at 30 June 1969 was 36,818. During the year 1968–69 the bulk electricity purchased was 459,758,000 kWh and the system maximum demand was 118,300 kW.

Northern Territory

At Darwin, supply was established by the Town Council in October 1934, but during April 1937 responsibility for generation and supply was transferred to the Northern Territory Administration. The Stokes Hill Power Station is now equipped with four turbo alternators with a total capacity of 47,000 kW. Old Diesel Power Station with a capacity of approximately 5,000 kW is available as a stand-by. A 66 kV transmission system is used in Darwin area. At Alice Springs the power station is equipped with a diesel generating plant of 8,000 kW total capacity. At Katherine the power station is equipped with a diesel generating plant of 2,700 kW total capacity, the generating plant at Pine Creek has a capacity of 180 kW and at Elliot power is supplied by a small automatic diesel alternator of 90 kW capacity. The total number of ultimate consumers served in the Territory at 30 June 1969 was 9,783.

Papua and New Guinea

Papua and New Guinea Electricity Commission. Responsibility for the operation and establishment of the electrical undertakings in Papua and New Guinea is vested in the Papua and New Guinea Electricity Commission, whose headquarters are located at Port Moresby. The Commission came into operation on 1 July 1963, and assumed the functions and responsibilities previously vested in the Electrical Undertakings Branch of the Department of Public Works. The Commission, on its own behalf, operates the public supplies in the main centres of population and, on behalf of the Administration, operates the supply in the minor centres and patrol posts, hospitals, agricultural establishments, etc., where the supply cannot be considered to be a fully commercial supply. It has also regulatory functions associated with the licensing of electricians and contractors, the control of franchise holders and the approval of appliances and electrical materials for use in the Territory.

Generating facilities. The Electricity Commission owns and operates diesel and hydro-electric facilities at Goroka, hydro-electric facilities at Port Moresby and diesel facilities at Lae, Madang, Samarai, Wewak, Rabaul and Kavieng, with a total installed capacity of 49,270 kW at 30 June 1969. The Kokopo Station was closed when the new transmission line from Rabaul came into operation in May, 1969.

	Hydro kW	*Diesel* kW	*Total* kW
Port Moresby	35,500	..	35,500
Lae	..	2,700	2,700
Madang	..	2,280	2,280
Goroka	400	1,000	1,400
Wewak	..	2,300	2,300
Rabaul	..	4,200	4,200
Kavieng	..	450	450
Samarai	..	440	440
Total	**35,900**	**13,370**	**49,270**

In addition, the Commission purchases bulk power from the hydro-electric power stations of Placer Development Ltd for consumption in the township of Lae. The total substation capacity of all the Commission systems combined amounts to approximately 71,000 kVA divided up in 481 stations. The number of consumers served by the Commission at 30 June 1969 was 14,258. The Commission also maintains the generating plant and distribution systems in all minor centres, acting as an agent of, and from funds provided by, the Administration. In the financial year 1968–69, 127 centres with a total installed capacity of approximately 6,500 kW were supplied with power. The townships of Wau and Bulolo are supplied exclusively with power generated by Placer Development Ltd.

Future Development. Work has commenced on the Sirinumu Dam. This will ensure adequate water for the full output of the Rouna 2 Power Station and provide potential for further development of the Laloki River to supply Port Moresby. This is planned for completion by December 1970.

Investigations are proceeding into the future development of the Laloki River and although investigations are not complete it appears that a third power station, near Rouna 1, and a balancing pond at Sogeri will be feasible.

Preliminary investigations of the Vanapa, Angabunga and Musa Rivers are nearing completion with indications that the Musa River will be the best for supply to Port Moresby following completion of the proposed 50,000 kW diesel power station at Baruni.

Officials from the International Bank for Reconstruction and Development visited the Territory between 29 June and 12 July 1970 to appraise the Upper Ramu Hydro-Electric Scheme. Should the Bank decide to finance the project, it is expected that the first stage, estimated to cost $26 million, will be in operation by 1975. This scheme will supply the main centres of Lae, Madang, Goroka and Mount Hagen and smaller intermediate centres.

Two further hydro-power sources in New Britain have been investigated for future development, the Kapiura River and Lake Hargy. Lake Hargy has not yet been fully investigated and the Kapiura River showed no potential. In view of the uncertainty of future hydro-electric power for New Britain, investigations into other power sources are being carried out. The present power station site at Rabaul is limited and a site for a new power station is being sought.