CHAPTER 27

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 internal Territory.

The information contained in the chapter relates to situations existing and projects contemplated in March 1972, 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. Statistics on the electricity industry are included in tables in Chapter 21, Manufacturing Industry.

INTRODUCTION

Distribution of population and location of electric 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 1971 thermal power equipment represented 70.9 per cent, hydro plant 26.8 per cent, and internal combustion and gas turbine equipment 2.3 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 coast 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 government 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 53 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 54, page 944.

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 23 Water Conservation and Irrigation of this issue and special detailed article in Year Book No. 42, pp. 1103–30.

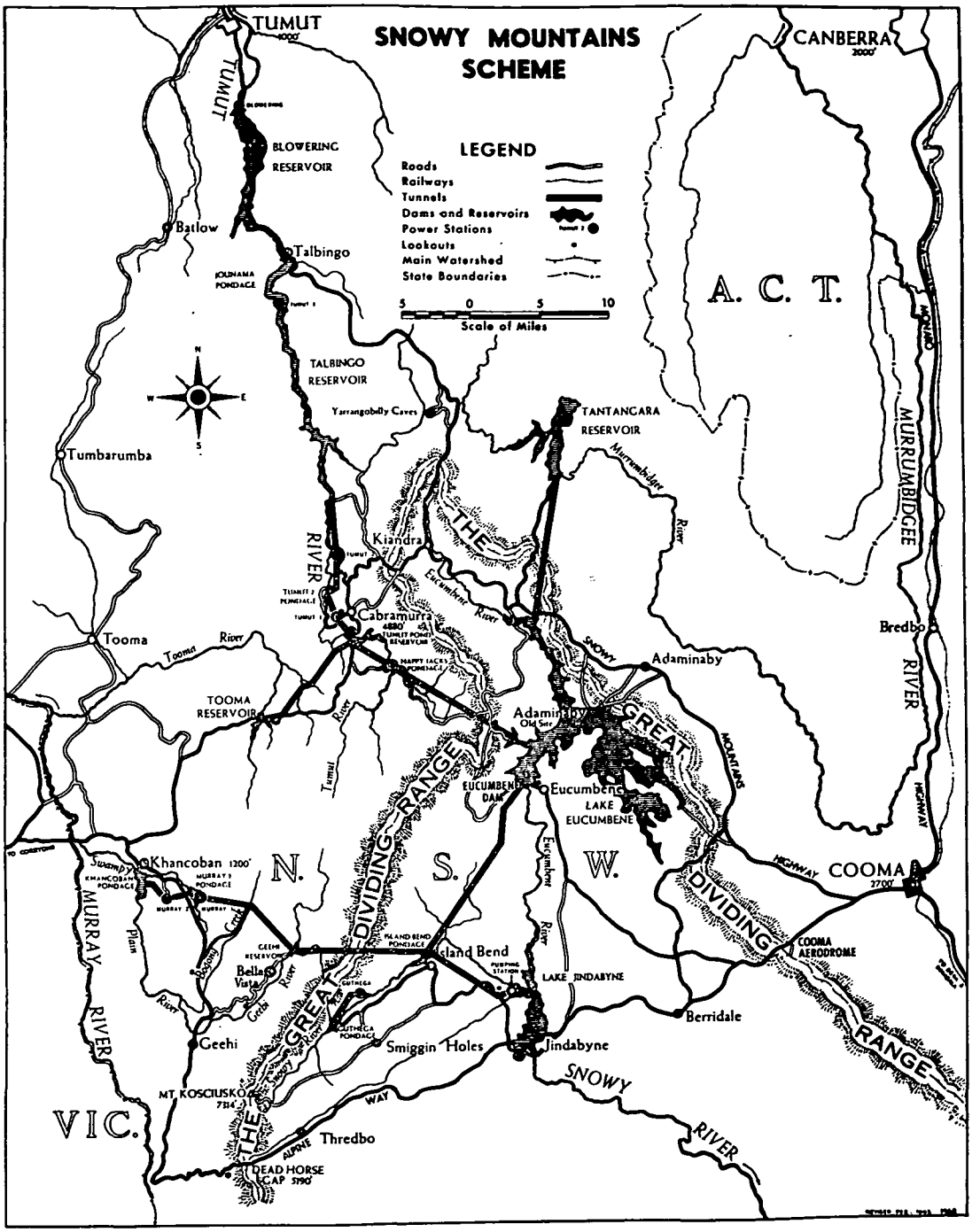
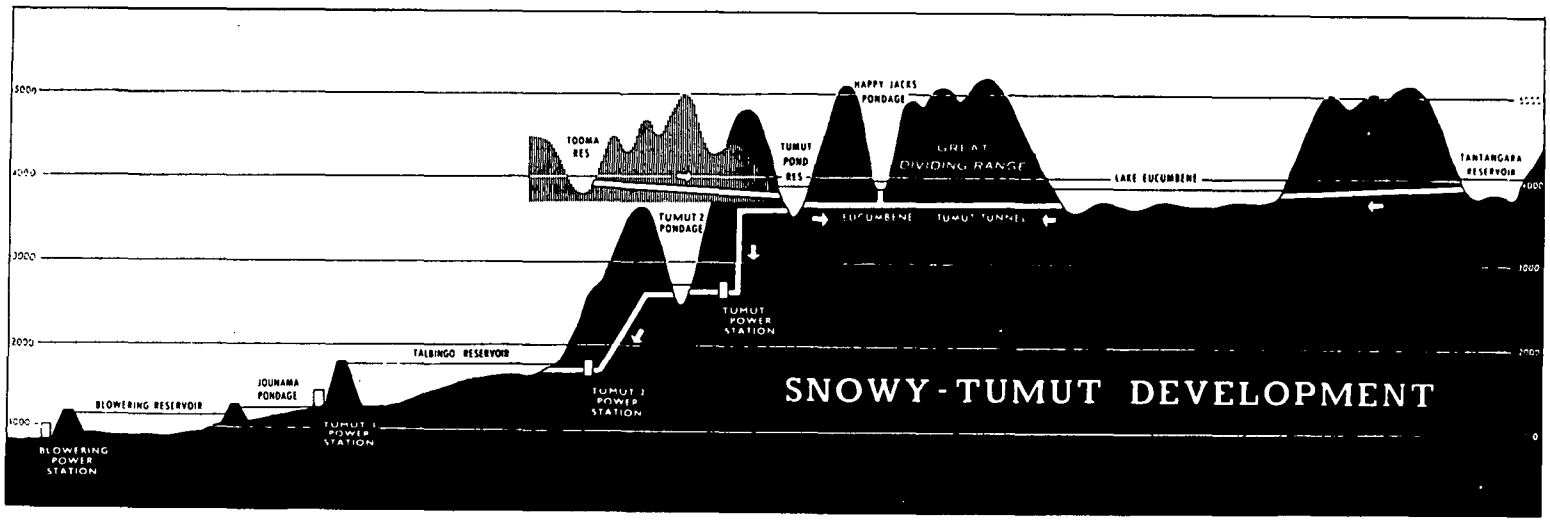
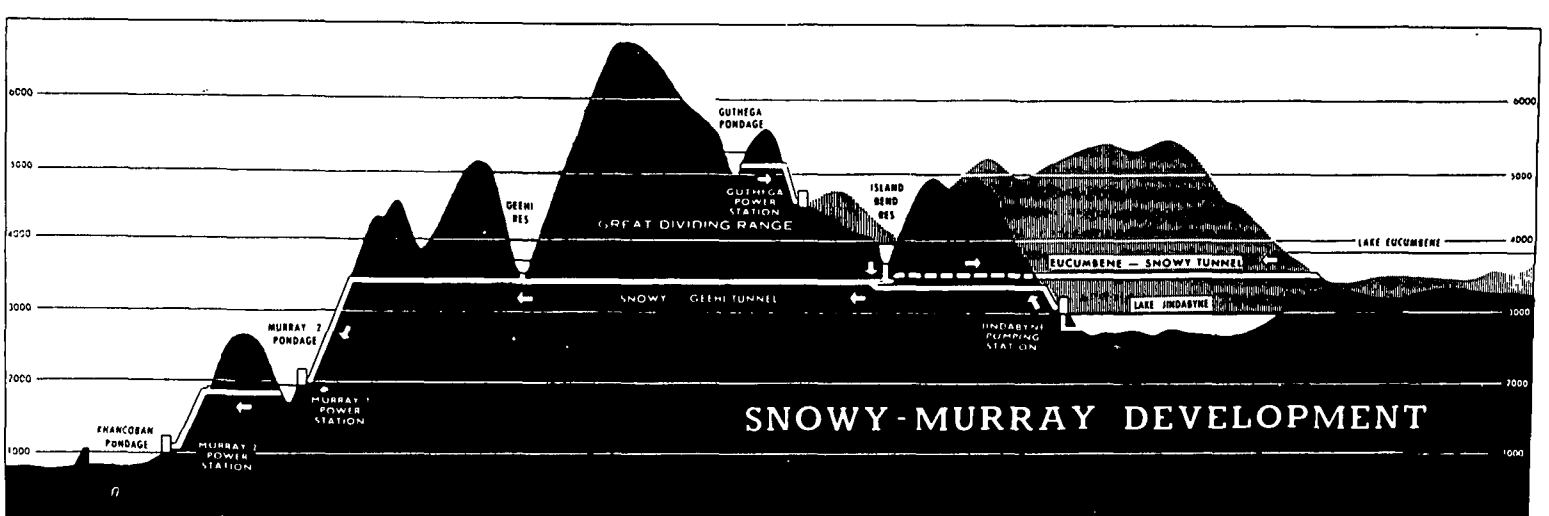

SNOWY MOUNTAINS SCHEME
LEGEND
Roads
Railways
Tunnels
Dams and Reservoirs
Power Stations
Lookouts
Main Watershed
State Boundaries
5 0 5 10
Scale of Miles
TUMUT
CANBERRA
A. C. T.
BLOWERING RESERVOIR
Batlow
Talbingo
TALBINGO RESERVOIR
Yarrangobilly Caves
TANTANGARA RESERVOIR
Tumbarumba
Kiandra
Cabramurra
Tooma
TOOMA RESERVOIR
Adaminaby
Eucumbene
LAKE EUCUMBENE
EUCUMBENE DAM
Khancoban
Island Bend
LAKE JINDABYNE
Jindabyne
Berridale
Geehi
Smiggin Holes
Thredbo
DEAD HORSE GAP
MT. KOSCIUSKO
COOMA
COOMA AERODROME
Bredbo
MURRUMBIDGEE RIVER
MURRAY RIVER
SNOWY RIVER
TUMUT RIVER
TOOMA RIVER
GREAT DIVIDING RANGE
N. S. W.
VIC.

PLATE 53

PLATE 54


TOOMA RES
HAPPY JACKS PONDAGE
TUMUT POND RES
GREAT DIVIDING RANGE
LAKE EUCUMBENE
TANTANGARA RESERVOIR
TUMUT 2 PONDAGE
EUCUMBENE TUMUT TUNNEL
TUMUT POWER STATION
TALBINGO RESERVOIR
JOUNAMA PONDAGE
BLOWERING RESERVOIR
TUMUT 1 POWER STATION
TUMUT 3 POWER STATION
BLOWERING POWER STATION
SNOWY-TUMUT DEVELOPMENT


GUTHEGA PONDAGE
GEEHI RES
GUTHEGA POWER STATION
GREAT DIVIDING RANGE
ISLAND BEND RES
LAKE EUCUMBENE
EUCUMBENE — SNOWY TUNNEL
SNOWY GEEHI TUNNEL
LAKE JINDABYNE
JINDABYNE PUMPING STATION
MURRAY 2 PONDAGE
MURRAY 1 POWER STATION
KHANCOBAN PONDAGE
MURRAY 2 POWER STATION
SNOWY-MURRAY DEVELOPMENT

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. Construction is also complete 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 began commercial operation in August 1971.

The total installed capacity of the scheme has now reached 2,224,000 kW.

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, 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, 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 1971 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.

Most electricity distribution areas have been consolidated into county districts consisting of a number of neighbouring local government 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, 217 are included in one or other of the thirty-four electricity county districts.

The Electricity Authority of New South Wales

The Electricity Development Act, 1945, confers broad powers on the Electricity 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. Under the subsidy scheme, local electricity suppliers receive subsidies from the Authority towards the cost of new rural lines. At 30 June 1971 the Authority was committed to the payment of $36,504,653 in subsidies, of which $26,689,374 had been paid. Further details of the operation of the scheme are given on page 956, Year Book No. 56.

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.

The Authority also administers the Traffic Route Lighting Subsidy Scheme, which provides for financial assistance to councils towards the cost of installation of improved lighting on traffic routes traversing built-up areas with the objective of reducing the incidence of night road accidents. Since the introduction of the scheme in 1964, subsidy has been approved in respect of some 582 miles of traffic routes throughout the State.

Generation and transmission

Of the State's electrical power requirements during the year ended 30 June 1971, 82.5 per cent was generated by coal fired power stations in New South Wales, 0.3 per cent by internal combustion plants, 16.5 per cent by hydro-electric stations (including 13.7 per cent obtained direct from the Snowy Mountains Scheme). Interstate imports accounted for 0.7 per cent of the State's electricity requirements.

Major generating stations. At 30 June 1971 the major power stations of the State system of the Electricity Commission of New South Wales and their effective capacities were as follows: Liddell (Hunter Valley), 500,000 kW; Munmorah (Tuggerah Lakes), 1.400,000 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. The total effective capacity of the Electricity Commission's system as at 30 June 1971 was 4,929,000 kW. The greater part of the Commission's generating plant is concentrated within a hundred mile radius of Sydney.

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 1971 there were in service 1,366 route miles of 330 kV (including 64 miles operating for the time being at 132 kV) and 3,205 miles of 132 kV transmission lines (including 50 miles operating for the time being at 66 kV or lower). There were also in service 2,621 miles of transmission line of 66 kV and lower voltages, and 106 miles of underground cable. The installed transformer capacity at the Commission's 141 sub-stations was 17,485,000 kVA.

Separate systems and total State installed capacity. Several local government bodies operate their own power stations and generate portion of their requirements which is supplemented by interconnection with the system of the Electricity Commission. Of these the more important are the Northern Rivers County Council (installed capacity 28,750 kW) and the North-West County Council (15,000 kW). In addition a private company operates small stations supplying the towns of Ivanhoe and Wilcannia. The aggregate effective capacity for the whole of New South Wales systems and isolated plants was 4,978,325 kW at 30 June 1971 and the number of ultimate consumers at this date was 1,613,967.

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 was commissioned in 1971 and will be followed by 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 the first of which is expected to come into operation in 1977.

The development of the 330 kV main system is continuing. New work in hand includes the construction of major 330 kV transmission centres at Armidale, Wagga Wagga and East Sydney. Plans to augment the transmission system during the next five years provide for the construction of 1,200 route miles of 330 kV lines, 1,000 miles of 132 kV overhead lines, and 15 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 942). Apart from this area, major hydro-electric stations are in operation at the Warragamba Dam (50,000 kW), Hume Dam (50,000 kW) and Burrinjuck Dam (20,000 kW). There are, in addition, five smaller hydro-electric installations in operation in various parts of the State. A pumped-storage hydro-electric system to produce 240,000 kW by 1976, is being installed as part of the Shoalhaven Scheme in conjunction with the Metropolitan Water Sewerage and Drainage Board.

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-government 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 and fuel undertakings and provide for statutory payments to State Consolidated Revenue.

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.

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 1970–71 from the Commission's three open cuts at Yallourn, Morwell and Yallourn North totalled 21,539,000 tons, of which 17,432,000 tons were used in the Commission's power stations. A further 3,765,000 tons of brown coal were used to manufacture 1,369,000 tons of briquettes, of which 217,000 tons were burnt in power stations. The only other fuel used in power generation was 49,000 tons of oil.

Generation in thermal stations is supplemented by energy from the Commission's hydro stations in the mountains 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 1971 the number of ultimate consumers in Victoria was 1,287,000 all served by the Commission except the extreme eastern settlements of Mallacoota (local generation) and Bendoc (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 1,045,000 at 30 June 1971. Of these some 877,000 were domestic, 77,000 industrial and 91,000 commercial. Retail supply is administered through the metropolitan branch and nine extra-metropolitan branches with headquarters at Geelong, Dandenong, Taralgon, Mildura, Ballarat, Benalla, Bendigo, Colac and Horsham. Branch and district supply offices are located in Melbourne and all other major cities and towns in Victoria.

Complete electrification of the State has virtually been achieved. By 30 June 1971 over one million homes and nearly 74,000 farms were supplied with electricity. Only a few remote areas remain out of reach of public supply mains.

Electricity production, transmission and distribution

Electricity generated in the State system or purchased by it totalled 14,086 million kWh in 1970–71. 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 1971 was 3,531,000 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 50 per cent of Victoria's electricity. Hazelwood, now completed, has 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), and 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 of the interconnected system. 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 1971 comprised over 62,000 miles of power-lines, 30 terminal receiving stations, 161 zone sub-stations, and more than 64,000 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 over 1,900 route miles.

Future development

Yallourn 'W' Power Station, now under construction, is located about half a mile west of the present Yallourn Power Station. The station will be the fourth brown coal burning power project built by the Commission in the Latrobe Valley. Its capacity will be 700,000 kW, provided by two 350,000 kW turbo-generators, the first due to come into service in 1972 and the second in 1974. With this project in operation, the State's power resources, including Victoria's entitlement from the Snowy Mountains Hydro Electric Authority, will have increased from 3,531,000 kW at June 1971 to 4,785,000 kW in 1974, an increase of 36 per cent.

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 and operate generating stations and transmission lines and to sell electricity in bulk.

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 275 kV 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, 90.0 per cent of the total production during 1970–71 being derived from this fuel. Hydro-electric stations, located mainly in North Queensland, provided 8.9 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. All 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 1970–71 totalled 6,331 million kWh. A further 20 million units were purchased in bulk from other producers of electricity for re-distribution to consumers.

At 30 June 1971 the total generating capacity of all Queensland power stations was 1,858,898 kW comprising 1,571,000 kW of steam plant, 135,208 kW of hydro-electric plant, 37,690 kW of internal combustion plant and 115,000 kW gas turbine plant.

The Southern electricity network is served by the following major power stations: Bulimba 'A' (65,000 kW), Bulimba 'B' (180,000 kW), Tennyson 'A' (120,000 kW), Tennyson 'B' (120,000 kW), Swanbank 'A' (396,000 kW), Swanbank 'B' (240,000 kW) and Howard (37,500 kW) together with gas turbine stations—Swanbank 'C' (30,000 kW) and Middle Ridge (60,000 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 (120,000 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 and emergency 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).

The electrical transmission and distribution systems within the State comprised over 51,000 circuit miles of electric lines at 30 June 1971. 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 1971 the total number of electricity consumers was 581,196 of whom 225,229 were in the Brisbane metropolitan area.

Future development

Major development of the State's generating capacity is concentrated on the construction of the following major power stations, at Gladstone (1,100,000 kW) and Swanbank 'B' (480,000 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 was commissioned during 1969–70 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 the end of 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' was commissioned 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 1971, the Electricity Trust operated plant with a capacity of 1,081,000 kW, and is the most important authority supplying electricity in the State. There were approximately 438,000 ultimate consumers of electricity in the State, of whom 431,000 were supplied directly and approximately 7,000 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 (480,000 kW).

The Trust operates two smaller power stations, the Mt Gambier Station has an installed capacity of 22,000 kW and Pt Lincoln 9,000 kW–both locations are connected with the Trust's interconnected system with 132 kV lines.

The two main fuels used by the Trust are sub-bituminous coal from Leigh Creek for the Port Augusta, Playford power stations and natural gas from the Gidgealpa–Moomba field for the Torrens Island station.

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 is empowered to co-ordinate all power undertakings in the State and to encourage and promote the use of electricity and other power. The Commission provides central power station supply through an interconnected grid system to the Metropolitan Area, the South-West and Great Southern areas, and an area extending eastward to Koolyanobbing. Beyond the limits of the interconnected system power is supplied to towns by diesel power stations operated by the Commission, local government authorities, private concessionaires, or mining companies. A scheme known as the Northern Areas State Power Scheme is also being developed. For this scheme the Commission purchases power in bulk to supply districts between Northampton and Dongara and to Perenjori and Morawa.

The total number of consumers at 30 June 1971 was 274,422, of whom 255,551 were supplied by the Commission. The number of consumers on rural holdings supplied by the Commission at 30 June 1971 was 13,867.

The activities of the interconnected system for the year ended 30 June 1971 were as follows: plant capacity, 529,500 kW; units generated, 2,446 million kWh; fuel used per unit (kWh) generated, 1.38 lb; coal used, 1,122,832 tons.

The first and second 120,000 kW units at the new Kwinana thermal generating station were commissioned in September 1970 and in March 1972 respectively. Two additional 120,000 kW units will be installed at the station before 1973, and two 200,000 kW units are scheduled for installation in 1975 and 1976.

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 a 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.

Output and capacity of hydro-electric system

The following table outlines the development of the Tasmanian generating system.

TASMANIAN POWER GENERATING SYSTEM

Station	*Year of completion*	*Head (in feet)*	*Generator capacity (kW)(a)*	*Average annual output (million kWh units)*
COMPLETED STATIONS				
Waddamana 'B'	1949	1,127	48,000	(b)
Tarraleah	1951	981	90,000	593
Butlers Gorge	1951	184	12,200	63
Trevallyn	1955	415	80,000	541
Tungatinah	1956	1,005	125,000	560
Lake Echo	1956	568	32,400	76
Wayatinah	1957	203	38,250	274
Liapootah	1960	361	83,700	455
Catagunya	1962	142	48,000	260
Poatina	1965	2,720	250,000	1,322
Tods Corner	1966	136	1,600	13
Meadowbank	1967	95	40,000	209
Cluny	1967	51	17,000	105
Repulse	1968	88	28,000	160
Rowallan	1968	161	10,450	40
Lemonthyme	1969	523	51,000	286
Devils Gate	1969	226	60,000	300
Wilmot	1971	825	30,600	126
Bell Bay	1971	(c)	120,000	788
Cethana	1971	324	85,000	409
Total	..	..	*1,251,200*	*6,580*
STATIONS UNDER CONSTRUCTION				
Paloona	1972	103	28,000	130
Fisher	1972	2,115	43,200	247
Bell Bay, Stage 2	1974	(c)	120,000	739
Gordon, Stage 1	1976	610	240,000	1,445
Total	..	..	*431,200*	*2,561*
ALL STATIONS				
Grand Total	..	..	**1,682,400**	**9,141**

(*a*) Emergency gas turbine generating capacity of 21,000 kW at Bell Bay and 10,000 kW at Macquarie Point (Hobart) not included. (*b*) Reserve plant only. (*c*) Thermal station.

The number of ultimate consumers at 30 June 1971 was 149,911.

New capacity

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

The Mersey–Forth Power Development is scheduled to be completed by 1972. This development involves diversion of the Mersey and Wilmot Rivers and their tributaries into the Forth River and the construction of seven distinct power stations. The 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 second stage of the station which will double the capacity is expected to be completed by 1974.

The Commission is conducting extensive surveys and investigation of other schemes with a view to further construction after the completion of the present programme. It is estimated that the potential which can be developed economically should ultimately harness 3,000,000 kW to the system.

Commonwealth Territories

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 1971 was 45,251. During the year 1970–71 the bulk electricity purchased was 567,416,000 kWh and the system maximum demand was 150,800 kW.

Northern Territory

Electricity is supplied in the main population centres of the Northern Territory by the Northern Territory Administration under the provisions of the *Supply of Services Ordinance* 1952–1965 and the Electricity Supply Regulations made pursuant thereto.

A steam turbo-generating station is operated together with an extensive distribution system in Darwin, and diesel generating stations and distribution systems at Alice Springs, Katherine, Pine Creek and Elliot. At Tennant Creek supplies of electricity are purchased in bulk from Peko Mines N.L. and sold to consumers through a distribution system owned by the Northern Territory Administration.

Capacities of generating stations as at 30 June, 1971 were: Darwin 47,000 kW, Alice Springs 9,704 kW, Katherine 5,403 kW, Pine Creek 200 kW, Elliot 150 kW.

The total number of consumers served in the Territory as at 30 June 1971 was 12,382, an increase of 11.8 per cent over that of the previous year.

Papua New Guinea

For details of electric power generation and distribution *see* Chapter 28, The Territories of Australia.

Statistical Summary

For a summary of operations of electricity establishments in 1968–69 and 1969–70, *see* Chapter 21, Manufacturing Industry, pages 726–7. The information contained therein is not comparable with that contained in previous issues of the Year Book; for an explanation of the differences *see* page 719 of this issue.