CHAPTER 18

ENERGY

Introduction

Australia is well endowed with energy resources and is presently one of only five OECD countries that are net energy exporters. It presently supplies about two-thirds of its oil requirements from domestic sources and should be able to maintain this relatively favourable situation for some years at least.

Estimates of Australia's demonstrated economically recoverable resources of energy as at December 1983 are:

Brown coal	37,366 megatonnes
Black coal	30,901 megatonnes
Uranium	474 kilotonnes U
Natural gas	629 teralitres
Crude oil and natural gas liquids	396 gigalitres

Additionally, there are huge inferred resources of black coal amounting to about ten times the demonstrated figure quoted above but presently uneconomic, and resources of oil shale equivalent to about ten times the level of crude oil and condensate resources.

In recognition of the importance of energy resources to Australia's national wealth, policies have been developed to respond to the changing pattern of world energy supplies, to try to minimise uncertainty for the future and to develop other energy sources which can substitute for oil in a wide range of uses, in both domestic and export markets. The basic aims of these policies are:

- to attempt to ensure that an adequate supply of energy is available at all times;
- to facilitate the efficient use of energy in Australia and the efficient development of Australia's energy resources in response to the needs of domestic and overseas energy markets; and
- to ensure the benefits of energy resource development are shared equitably throughout the Australian community.

More specific objectives in relation to liquid fuels are:

- to prepare Australia for major interruptions to oil supplies through stocks and emergency allocation schemes and other short lead time measures;
- to achieve the optimum economic level of liquid fuels self-sufficiency through, for example:
  - encouraging the conservation and more efficient use of liquid fuels;
  - replacing the use of oil by relatively abundant energy sources such as coal and natural gas;
  - encouraging petroleum exploration and development; and
  - developing technologies for alternative energy sources, particularly liquid fuels and renewables.

In establishing an appropriate framework within which Australia's energy industries can develop, the Government attaches key importance to the pricing and fiscal environment surrounding production, consumption and trade of Australia's energy resources. Realistic pricing of all energy resources is of fundamental importance in developing this framework. The policy of import parity pricing of indigenous crude oil has been, and is important in meeting the Government's policy objectives in the energy field generally and in the field of liquid fuels in particular. This is supplemented however by measures such as support for energy research and development. In this respect a total of $115 million has been committed to energy research and development through the National Energy Research, Development and Demonstration Program since its inception in 1978. The primary focus of the Program has been the co-ordination and support of research and development activity in Australia to achieve a full understanding of the extent and quality of Australia's energy resource base, and the development of appropriate technologies to enable these resources to be used to their fullest extent for the benefit of the Australian people.

The Government has indicated that a priority matter for its attention is reform of the existing arrangements for the taxation of energy and other extractive industries. It has expressed a preference for the replacement of the present complex system of Commonwealth and State taxes, royalties, licence fees and other charges currently applicable to many extractive industries with more equitable and efficient profits-related taxes.

In a joint statement dated 27 June 1984 the Treasurer and the Minister for Resources and Energy announced details of a resource rent tax to apply from 1 July 1984 to offshore petroleum projects which have not yet reached the development stage (known as "greenfields" petroleum projects). The tax will be payable on those projects earning, before company tax, a minimum rate of return on project outlays equal to the long term bond rate plus 15 percentage points. Profit in excess of this threshold rate will be taxed at a rate of 40 per cent, additional to company tax.

The resource rent tax is intended to replace all existing excise and royalties on greenfields petroleum projects. It will be levied prior to company tax and be deductible for company tax. Deductions from resource rent tax are available for current and capital expenditure excluding payments related to debt and equity capital and for related exploration expenditure.

Enabling legislation for the resource rent tax is expected to be introduced into Parliament during the 1985 Autumn Session.

Advice and co-ordination

Institutional Arrangements

The Commonwealth Minister for Resources and Energy has portfolio responsibility for national energy policy matters, including the commercial development of hydrocarbon fuels and minerals.

The Department of Resources and Energy provides advice to the Minister on energy policy and provides support for a number of advisory bodies including the National Energy Research Development and Demonstration Council (NERDDC), the Australian Minerals and Energy Council (AMEC), the National Oil Supplies Advisory Committee (NOSAC), the National Petroleum Advisory Committee (NPAC), the National Fuels Emergency Consultative Committee (NFECC), and the Australian Council Coal Consultative (ACCC).

It is also responsible for implementation of action required from Australia's membership of the International Energy Agency (IEA) and for the national system of accounting for a control of nuclear materials under Australia's Agreement with the International Atomic Energy Agency (IAEA).

International Energy Agency

The International Energy Agency (IEA) was established in Paris in November 1974 as an autonomous institution within the framework of the Organisation for Economic Co-operation and Development. Australia joined the IEA in May 1979.

The Agency carries out the International Energy Program and the Long Term Co-operation Program. These programs aim to prepare member countries against risk of oil supply disruptions and to share remaining supplies in the event of a severe oil shortfall, to develop alternative energy sources and the more efficient use of energy including through co-operative research and development programs, and to promote co-operative relations with other oil-producing and oil consuming countries.

The main decision-making body of the IEA is the Governing Board. The Board meets as required at Ministerial level and several times a year at senior official level. The IEA has standing groups on Long Term Co-operation, the Oil Market, Emergency Questions, a Committee on Research and Development and an ad hoc group on International Energy Relations.

Research and Development

NERDDC

The National Energy Research, Development and Demonstration (NERD&D) Program has been established to stimulate the level of energy research, development and demonstration in Australia. Grants under the NERD&D Program are approved by the Minister for Resources and Energy who is advised by the National Energy Research, Development and Demonstration Council (NERDDC).

The Council consists of twelve members drawn from government, laboratories, private industry and tertiary institutions. It is supported by seven Technical Standing Committees covering all major areas of energy technology.

Government, industry and university research bodies are eligible to apply for grants under the NERD&D Program which is administered by the Department of Resources and Energy. From the start of the Program in 1978, $115 million had been committed by June 1984.

Further Commonwealth support for energy research, development and demonstration is provided through budget appropriations to Commonwealth agencies such as CSIRO, BMR and the Australian Atomic Energy Commission (AAEC), the Australian Industrial Research and Development Incentives Scheme, and Commonwealth funding of all Australian universities.

Commonwealth Scientific and Industrial Research Organization (CSIRO)

Energy research within the Institute of Energy and Earth Resources is carried out with the objectives of improving methods of locating, evaluating, defining and characterising Australia's energy resources and of planning their development and effective use, consistent with the minimisation of environmental stresses. Divisions of the Institute engaged in energy research are the Division of Geomechanics at Syndal (Vic.); the Division of Energy Chemistry at Lucas Heights (N.S.W.); the Division of Energy Technology at Highett (Vic.); the Division of Fossil Fuels at North Ryde (N.S.W.); the Division of Mineral Chemistry at Port Melbourne (Vic.); the Division of Mineral Engineering at Clayton (Vic.); the Division of Mineral Physics at North Ryde (N.S.W.), Lucas Heights (N.S.W.) and Port Melbourne (Vic.), and the Physical Technology Unit at Ryde (N.S.W.).

Research on certain renewable sources of energy is carried out in the Institute of Biological Resources (Divisions of Plant Industry, Water and Land Resources and the Centre for Irrigation Research).

AMEC

The Australian Minerals and Energy Council (AMEC) was established on 9 April 1976 by agreement between State and Federal mines and energy Ministers and replaced the former Australian Minerals Council. AMEC is principally a body for consultation on minerals and energy matters and provides a forum for Ministers to discuss policy issues of mutual concern and coordinate policy action. An AMEC Advisory Committee which is composed of the Departmental Heads or their nominees provides for officer level consultation and information exchange. AMEC establishes committees, subcommittees etc, to undertake specific tasks and report back through its Advisory Committee as the need arises. At present, the following are in place:

- Co-ordinating Committee on Energy Conservation
- Standing Committee on Offshore Petroleum Legislation
- Commonwealth/State Standing Joint Study Group on Raw Materials Processing
- Working Group on the Impact of the Activities of the Heritage Commission on Resources Developments
- Sub-committee on the Development of Alternative Commonwealth and State Liquid Fuels Emergency Legislation
- Working Party on Power Supplies to Remote Properties.

ACCC

The Australian Coal Consultative Council (ACCC) was established following a Coal Industry Conference in Canberra on 30 March 1983. Its terms of reference are to review and report from time to time on the economic and structural problems of the industry. The Council is a tripartite body, chaired by the Minister for Resources and Energy. Its membership comprises the New South Wales and Queensland Ministers responsible for the industry, coal mine proprietors, mining unions and the ACTU. The Australian Mining Industry Council has 'observer' status. The ACCC has met four times, most recently on 14 September 1984.

A National Research Group was set up at the November 1983 meeting, which commissioned four Working Party reports examining particular problems of the industry. These reports have been completed and considered by the ACCC. An Advisory Committee was established at the third ACCC meeting, on 21 June 1984. The Committee, whose membership reflects that of the ACCC, is to meet more frequently (approximately monthly) than the ACCC, and report to the ACCC and through it to the relevant Federal and State Ministers.

The ACCC has been effective in developing a greater level of understanding of the industry's situation, particularly on industrial relations issues. This has led to the development of a labour adjustment package to meet the problems of the industry—particularly in N.S.W.

NOSAC

The National Oil Supplies Advisory Committee (NOSAC) was formed in 1983 by the amalgamation of separate Commonwealth/industry and Commonwealth/State bodies set up during the period of tight oil supply in 1979. Representatives of the Commonwealth Government, State Government energy authorities and major domestic oil producers and refiners meet in NOSAC about three times a year to review the situation and outlook for domestic and international oil supplies. Matters discussed include oil production, new oil and gas developments, imports, exports, stock levels, regional shortages, industrial relations, shipping, technical matters and government policies affecting the oil industry.

NPAC

Membership of the National Petroleum Advisory Committee (NPAC) is drawn from agricultural, general aviation, fishing, manufacturing, mining, shipping and transport industries, oil industry, trade union movement and motorists' organisations as well as Commonwealth, State and Territory Governments. The Department of Resources and Energy provides the Secretariat for NPAC. In accordance with the NPAC recommendations the Commonwealth Government has enacted the *Liquid Fuel Emergency Act 1984* and established with the States and the Northern Territory the National Fuels Emergency Consultative Committee.

NFECC

The National Fuels Emergency Consultative Committee (NFECC) chaired by the Commonwealth and comprising officials of the Commonwealth, States and the Northern Territory, was established in late 1983 to consult and advise Governments on matters relevant to the preparation for, and detailed management of, a national liquid fuels crisis; and to act as the prime channel of consultation between Governments in the event of such a crisis. NFECC meets three or four times a year in a programme of co-ordinated arrangements for managing a national fuel crisis.

Resources

Black coal

Black coal is currently second to petroleum products as the largest source of primary energy in Australia. By world standards, in relation to present population and consumption, Australia is fortunate in the availability of easily worked deposits of coal. The country's main black coal fields are located in New South Wales and Queensland, not far from the coast and from the main centres of population.

Australia's inferred resources of black coal are very large, amounting to over 500,000 megatonnes (Mt). At 31 December 1983, Australia's demonstrated economic resources of black coal were estimated to total 53,852 Mt of which 30,901 were considered recoverable. These recoverable resources are located largely in the Sydney Basin in New South Wales and the Bowen Basin in Queensland. There are other coal-bearing basins in New South Wales and Queensland, and small deposits are being worked in Western Australia, South Australia and Tasmania. Australian saleable black coal production in 1983-84 was 105.5 Mt.

For further details relating to the production of black coal in Australia see Chapter 16, Mineral Industry. Details about the nature and age of black coal are given in Year Book No. 64, pages 460 and 461.

Brown coal

Australia's measured and indicated resources of brown coal are estimated at 42,000 Mt, located principally in Victoria's Latrobe Valley (35,030 Mt). Small deposits exist in other areas of south Gippsland, in south-eastern Victoria at Gelliondale and in the south-central region at Anglesea, Bacchus Marsh and Altona. Deposits are also known at many places along the southern margin of the continent, as far north as central Queensland, and large deposits are being tested in the Kingston area of South Australia, the Esperance area of Western Australia and at Rosevale in the north-east of Tasmania.

Because brown coal has a relatively low specific-energy value and high water content, its utilisation depends on large-scale, low-cost mining and negligible transportation costs in its raw state.

In Victoria the brown coal industry has reached a high degree of sophistication in mining, on-site development for power generation, briquetting and char manufacture. Production of brown coal in Victoria during 1983 was 33.1 Mt. The brown coal deposits of the Latrobe Valley have been developed by the State Electricity Commission of Victoria (SECV) for the generation of electricity. By the end of 1983, about 830 Mt of raw brown coal had been mined.

Energy research and development statistics

Estimates of the expenditure on energy R&D carried out in Australia during 1982–83, and classified by energy objective, are presented in the table below.

The estimate of manpower resources devoted to energy R&D in Australia during 1982–83 was 3,222 man years. Of this amount, business organisations accounted for 1,079 man years, general government organisations for 1,155 man years and higher education organisations for 988 man years.

More detailed statistics are contained in the ABS publication *Research and Experimental Development; Energy Production, Utilisation and Conservation, All Sectors, Australia, 1982–83* (8110.0)

ENERGY RESEARCH AND EXPERIMENTAL DEVELOPMENT(a), AUSTRALIA, 1982-83
DETAILS OF R & D EXPENDITURE BY ENERGY OBJECTIVE(b)

($'000)

Energy objectives(b)		*Sector of performance(d)*			*Source of funds(f)*	
Energy codes	*Description*	*Total expenditure(c)*	*Business enterprises(e)*	*General government and higher education*	*Industry*	*Government*
	Production and utilisation of energy—					
513	Oil and gas—mining extraction techniques	818	n.p.	n.p.	70	748
111	—refining, transport and storage	3,586	2,620	967	2,633	953
112,523,533	—other	10,110	2,230	7,880	2,897	7,213
113,114,514,524,534	Oil shale and tar sands	7,991	n.p.	n.p.	425	7,566
512	Coal—mining extraction techniques	9,520	n.p.	n.p.	5,990	3,531
121	—preparation and transport	9,159	5,136	4,024	3,930	5,230
122	—combustion	5,113	2,808	2,305	2,873	2,240
211	—conversion	13,550	2,503	11,046	1,560	11,990
123,522,532	—other	8,114	3,449	4,665	2,867	5,247
131	Solar—heating and cooling	5,913	2,778	3,135	2,613	3,300
132	—photo electric	4,065	682	3,383	329	3,736
133	—thermal electric	1,377	431	946	469	907
141	Nuclear—non-breeder—light water reactor	1,850	—	1,850	1	1,849
142	—other converter reactor	—	—	—	—	—
143,511,521,531	—fuel cycle	13,980	n.p.	n.p.	736	13,243
144	—supporting technologies	387	n.p.	n.p.	n.p.	n.p.
145	—breeder	—	—	—	—	—
146	—fusion	7,714	n.p.	n.p.	n.p.	n.p.
151	Wind	862	283	578	301	561
152	Ocean	56	—	56	—	55
153	Geothermal	60	—	60	—	60
221	Biomass	6,929	2,644	4,285	2,497	4,432
154	Other sources and new vectors	2,615	2,100	515	1,871	745
	Conservation of energy—					
311	Industry	7,708	5,605	2,103	5,283	2,425
312	Residential and commercial	6,062	3,349	2,713	3,133	2,929
313	Transportation	13,939	8,356	5,582	6,837	7,102
314	Other	1,645	1,298	348	1,174	471
	Other energy R & D (including supporting technologies)—					
411	Electric power conversion	4,098	2,533	1,565	2,201	1,897
412	Electricity, transmission and distribution	3,031	497	2,534	535	2,496
413	Energy storage, n.e.c.	1,215	640	575	608	606
414	Energy system analysis	2,001	78	1,923	55	1,946
415	Other	3,316	245	3,071	221	3,096
	Total all energy objectives	**156,785**	**59,046**	**97,739**	**54,109**	**102,676**

(*a*) Refers to R & D activity predominantly directed towards producing, storing, transmitting, utilising and conserving energy. (*b*) The energy objective categories represent ultimate national needs rather than the immediate objective of the researcher or the organisation performing the energy R & D. (*c*) Includes expenditure associated with overhead staff providing indirect services to energy R & D. (*d*) The sector classification used is adapted from the guidelines specified by the OECD for use in the conduct of R & D studies. (*e*) Excludes enterprises in ASIC Division A—i.e. enterprises mainly engaged in agriculture, forestry, fishing and hunting. (*f*) In accordance with IEA practice, source of funds are classified as either Industry or Government.

Petroleum

For a definition of petroleum, together with a brief description of recovery techniques and the history of the search for petroleum in Australia, *see* Year Book No. 64, pages 461 and 462.

Major prospects for new oil discoveries are in the sedimentary basins off the north-west coast of Australia. It is likely that a significant amount of the oil in these areas will be contained in a small number of large fields. Extrapolation from known areas suggests that undiscovered oil will be of the lighter types and that more gas fields than oil fields will be found. Assessments by the Bureau of Mineral Resources, Geology and Geophysics in March 1984 indicate that there is a 50 per cent chance of finding at least another 413 gigalitres (GL) (2,600 million barrels) of crude oil in Australia. This compares with demonstrated economic resources of 235 GL (1,478 million barrels) and demonstrated subeconomic resources of 53 GL (333 million barrels) as at 31 December 1983.

PETROLEUM RESOURCES (a) AS AT 31 DECEMBER 1983

(*Source:* Department of Resources and Energy)

Basin	*Demonstrated Economic (b)*				*Demonstrated Sub-economic (c)*			
	Crude oil GL	*Condensate GL*	*LPG GL*	*Sales gas 10^6m^3*	*Crude oil GL*	*Condensate GL*	*LPG GL*	*Sales gas 10^6m^3*
Bowen/Surat/Adavale (Qld)	1	—	—	2	—	—	—	6
Gippsland (Vic)	207	23	49	188	—	—	—	—
Gippsland/Bass/Otway (Vic./Tas.)	—	—	—	—	26	7	5	57
Cooper/Eromanga (S.A./Qld)	12	6	11	71	3	1	2	22
Carnarvon/Canning (W.A.)	10	42	27	350	—	—	—	—
Carnarvon/Browse/Bonaparte (W.A./N.T.)	—	—	—	—	24	19	7	768
Perth (W.A.)	1	—	—	4	—	—	—	—
Amadeus (N.T.)	4	3	—	14	—	—	—	—
Total	**235**	**74**	**87**	**629**	**53**	**27**	**14**	**853**

(*a*) Based on the McKelvey classification which sub-divides resources in terms of the economic feasibility of extraction and their certainty of occurrence. (*b*) Demonstrated economic resources are resources judged to be economically extractable and for which the quantity and quality are computed from specific measurements and extrapolation on geological evidence. (*c*) Demonstrated sub-economic resources are similar to demonstrated economic resources in terms of certainty of occurrence but are judged to be sub-economic at present.

PETROLEUM PRODUCTION IN AUSTRALIA

(*Source:* Department of Resources and Energy)

Year	*Crude oil and Condensate ML*	*LPG (a) ML*	*Natural gas GL*
1979–80	23,667	3,111	9,008
1980–81	23,052	2,982	10,435
1981–82	22,378	3,029	11,550
1982–83	22,069	2,906	11,654
1983–84	26,827	3,129	12,094

(*a*) Naturally occurring.

Crude Oil and Condensate

Indigenous production of crude oil and condensate increased markedly in 1983–84 in response to good industrial relations, reduction of technical constraints on Bass Strait production, the commissioning of new production facilities in the Cooper Basin and the entry into production of the Jackson field in southwest Queensland. Following the emergence of a surplus of light refinery feedstocks above the absorption capacity of local refiners, exports of surplus Cooper Basin condensate and Bass Strait oil commenced in August and November 1983. By June 1984 indigenous crude oil production, excluding condensate and LPG, was running at close to 80 ML a day. During 1983-84 overall self-sufficiency in liquid fuels rose to 77 per cent, a significant rise on the 66 per cent of a year earlier.

Liquefied petroleum gas

Liquefied petroleum gas (LPG) is a valuable co-product of oil and gas production and petroleum refining. The major constituents of LPG are propane, propylene and iso- and normal-butane, which are gaseous at normal temperatures and pressures and are easily liquefied at moderate pressures or reduced temperature. Operations involving LPG are expensive relative to other liquid fuels because LPG has to be refrigerated or pressurised when transported or stored. LPG is an alternative transport fuel for high mileage vehicles in capital cities as well as a petrochemical feedstock and a traditional fuel.

Identified economically recoverable resources of LPG at December 1983 of 87 000 megalitres (ML) are concentrated in Bass Strait, the North West Shelf and the Cooper Basin.

Production of naturally occurring LPG in Australia in 1983–84 was 3 129 ML, virtually all being extracted from crude oil and natural gas from the Bass Strait fields. About 74 per cent of Australia's LPG production is exported (2 840 ML in 1983–84)—mainly to Japan. Domestic consumption of 1 123 ML in 1983–84 was met by 699 ML of product obtained from refineries with supply shortfalls being met by naturally occurring Bass Strait product.

Production of LPG from the Cooper Basin commenced in July 1984. Annual output from the Basin is expected to be around 1 150 ML.

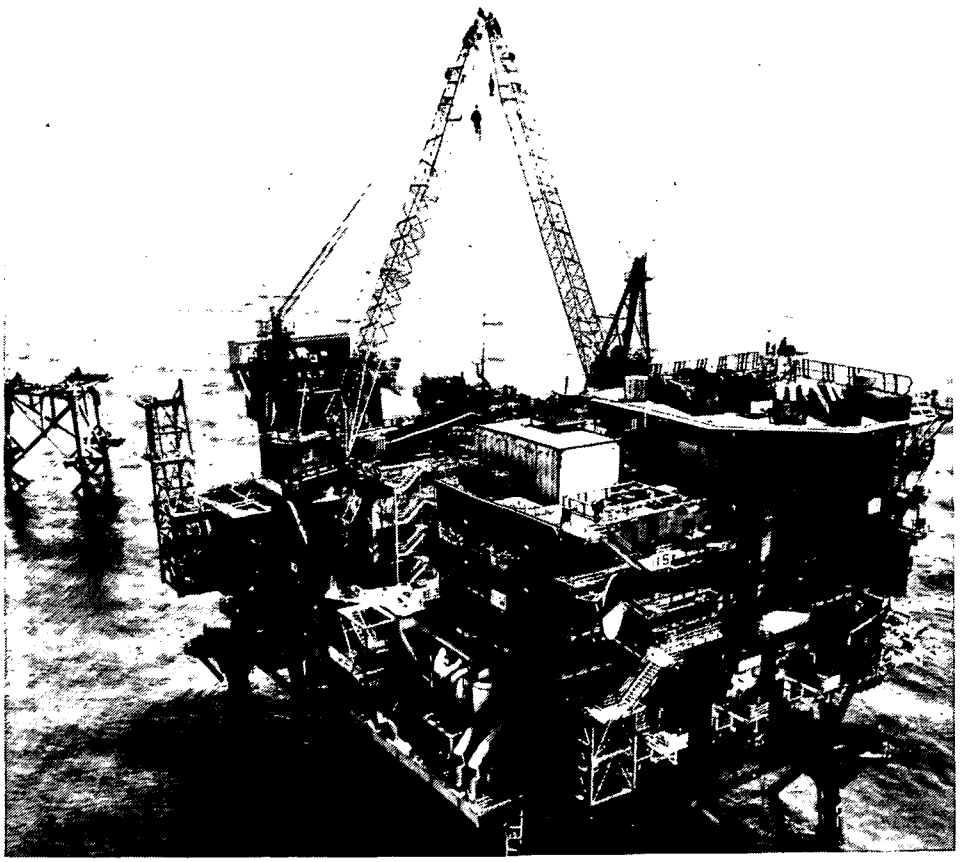
North West Shelf Project

In August 1984 the first phase of the North West Shelf Project to pipe natural gas from the North Rankin field to the Pilbara, Perth and South West of Western Australia commenced operation. The final cost of construction was $2 100 million.

The North Rankin and other fields on the North West Shelf are recognised as among the largest natural gas reserves in the world. Gas is piped from 134 kilometres off-shore to a treatment plant on the Burrup Peninsula near Dampier before delivery to markets in the south-west of the State via a 1 500 kilometre pipeline. This pipeline, costing $926 million, was built by the State Energy Commission of Western Australia and was the largest project ever undertaken by the Commission. Production from the North Rankin Field, amounting to over 4 000 million cubic metres per annum, will replace that available from almost depleted smaller fields north of Perth.

Commencement of the second phase, involving the export of liquefied natural gas (LNG) overseas, is awaiting agreement between the Joint Venturers, LNG buyers and State and Federal Governments.

In terms of scale and complexity the North West Shelf Project is one of the largest energy resource projects to be undertaken in the world. It is expected to cost approximately $11 000 million to bring to its peak rate of production.



The first of the North West Shelf production platforms photographed under construction. Situated 134 kilometres off shore, it commenced operations in August 1984.

Australian Information Service
Courtesy of Woodside Petroleum

Pricing of Australian crude oil

The pricing of Australian crude oil at import parity levels is fundamental to energy policy in Australia. Crude oil is a scarce and valuable resource and the Government considers that it should be competitively priced, to ensure that its usage recognises this value. Import parity pricing is considered essential to encourage:

- conservation of liquid fuels;
- exploration and development;
- substitution by more plentiful gaseous and solid fuels; and
- the economic development of liquid fuel substitutes.

Import parity pricing provides the basis for the long-term security of supply for Australia and the continuous adaptation of the Australian economy to changing world energy prices.

The present pricing and excise arrangements are based on announcements made by the Commonwealth Government in June 1983 and April 1984. Refiners pay and producers receive the appropriate import parity prices (IPP) for all liftings of indigenously produced crude oil.

The import parity prices are currently reviewed every six months (1 January and 1 July), but more frequently if there are major changes in circumstances. The prices are based on the landed costs of Saudi Arabian light crude oil at the nearest refinery port to the producing area and then adjusted for domestic freight cost and quality differentials. The current import parity prices from 1 July 1984 are $222.54/kl ($35.36/barrel) for Bass Strait crude, $224.06/kl ($35.61/barrel) for Barrow Island, $221.47/kl ($35.19/barrel) for Cooper/Eromanga Basin, $216.05/kl ($34.33/barrel) for Jackson, $210.11/kl ($33.39/barrel) for Dongara, $229.42/kl ($36.46/barrel) for Bowen/Surat Basin, $218.73/kl ($34.76/barrel) for Blina/Sundown, $209.34/kl ($33.27/barrel) for Mt Horner, and $219.09/kl ($34.82/barrel) for Mereenie.

For projects which had reached the development stage on 1 July 1984 and new onshore projects, producers pay excise to the Commonwealth and royalty to the State (if onshore) or Commonwealth (if offshore). Excise is paid at a rate based on the annual production of the producing area and is levied as a percentage of the Bass Strait IPP. Different excise scales are applicable to oil discovered before 18 September 1975 ("old" oil) and oil discovered on or after that date ("new" oil). The rates are given in the following table.

CRUDE OIL PRODUCTION: EXCISE PERCENTAGES PAID AND PRODUCER RETURNS, AUSTRALIA

Annual production range	*Excise rate (Percentage of import parity price)*			
	'Old' oil		'New' oil	
Megalitres	*Marginal excise rate*	*Average excise rate*	*Marginal excise rate*	*Average excise rate*
0-50	—	—	—	—
50-100	5	2.50	—	—
100-200	15	8.75	—	—
200-300	20	12.50	—	—
300-400	40	19.38	—	—
400-500	70	29.50	—	—
500-600	80	37.92	10	1.67
600-700	87	44.93	20	4.27
700-800	87	50.19	30	7.50
Greater than 800	87	n.a.	35	n.a.

Offshore projects in 'greenfields' areas, that is offshore areas not covered by production licences granted before 1 July 1984 and the permit areas from which they were drawn, will be subject to a resource rent tax. The tax will replace existing excise and royalty arrangements.

Crude Oil Allocation Scheme

The crude oil allocation scheme was designed to stimulate the production of Australian crude oil by guaranteeing a market for this production which was then a relatively expensive source of crude oil. The present allocation scheme first came into operation in September 1971. On 17 September 1980 the then Minister for National Development and Energy announced the extension of this scheme, subject to some modifications, until 31 December 1984.

The Scheme provides for the allocation of indigenous crude oil to refiner/marketers based on their market share of most refined petroleum products sold in Australia.

An important modification made to the crude oil allocation scheme in 1980 was that from 1 January 1981, producers of crude oil who continue the sale of gas condensate (liquid petroleum produced in association with natural gas) may retain an equivalent volume of crude oil for their own use or disposal. This producers' entitlement to crude oil is however subject to the crude oil excise and import parity pricing arrangements. Condensate marketed separately from a crude oil stream is not subject to allocation and excise and is sold at free market prices.

In June 1984, the Government announced that exports of Bass Strait crude oil which are surplus to domestic refiners' requirements would continue to be permitted until December 1984 together with exports of condensate. Government approval would be required for each export cargo.

In February 1984, the Government announced that a major review of the Crude Oil Allocation Scheme would be undertaken to help in making decisions about its future. Two discussion papers have been published and an announcement of the allocation arrangements to apply in 1985 and beyond is expected shortly.

Pricing of liquefied petroleum gas (LPG)

The Commonwealth Government sets the price that the producers receive for LPG sold for automotive and traditional domestic, commercial and industrial users. Following an extensive review, new pricing arrangements came into force on 28 March 1984 and will apply until the end of March 1987. Adjustments to the wholesale price will be made on 1 October and 1 April each year on the basis of the average monthly export parity price from 1 April 1984 to the month preceding the new price date, but increases will not be allowed to exceed rises in the fuel and light component of the consumer price index for the latest six month period prior to the adjustment date. The designated price on 28 March 1984 was $244.75 per tonne, representing the export parity price on 1 March 1984. This arrangement does not apply to non-traditional commercial, industrial and petrochemical users or exports. In these areas the price is determined by commercial negotiation.

Under the excise arrangements announced in April 1980, producers of naturally occurring LPG from fields in production prior to 17 August 1977 pay excise at a rate equivalent to 60 per cent of the average return to producers on both domestic and export markets in excess of $147 per tonne. LPG from fields brought into production on or after 17 August 1977 is free from excise. Adjustments to the LPG excise rate are made on 1 April and 1 October each year.

A subsidy is paid to households and commercial and industrial users in areas without access to natural gas, and was reviewed in March 1984. Until 30 September 1984 the subsidised wholesale price will be $224.44 per tonne and subsidy rate was $20.31 per tonne. Future adjustments in the subsidised price will be made by adjusting the present price in accordance with changes in the fuel and light component of the consumer price index.

The pricing and subsidy arrangements will be reviewed early in 1987.

Oil shale

A description of the nature and location of Australian oil shale deposits is given in Year Book No. 67, page 468.

Major investigations into oil shale development are concentrated on the Condor and Rundle deposits.

A $US24 million feasibility study on the Condor project finished on 30 June 1984. The Japanese participants, Japan Australia Oil Shale Corporation (JAOSCO), now have the exclusive right until 30 June 1985 to decide on their future involvement in the project.

A three-year feasibility study on the Rundle project will be completed by early 1985. Participants are Esso Australia, Southern Pacific Petroleum and Central Pacific Minerals.

Uranium

Australia has about 30 per cent of the Western world's low-cost uranium reserves. Deposits occur in the Northern Territory, Western Australia, South Australia and Queensland.

The major use for uranium is as a fuel in nuclear reactors. It is also used for power generation in atomic energy research programmes.

Uranium was first observed in Australia in 1894 but systematic exploration did not begin until 1944 following requests from the United Kingdom and United States Governments. A number of significant deposits were identified, particularly in the Katherine/Darwin region of the Northern Territory and the Mt Isa/Cloncurry region in Queensland. This initial phase of exploration activity reached a peak in 1954.

In the period 1954-71 about 9,200 tonnes of uranium oxide concentrate was produced from five plants at Rum Jungle, Moline and Rockhole in the Northern Territory, Mary Kathleen in Queensland and Radium Hill in South Australia. Uranium requirements for defence purposes decreased in the early 1960's and uranium demand and prices fell rapidly, whereupon exploration for uranium almost came to a standstill.

A revival in exploration in the late 1960s was encouraged by the announcements in 1967 of a new export policy, designed to encourage exploration for new uranium deposits while conserving known resources for future needs in Australia. The renewed exploration activity which followed was very successful—major discoveries were found in South Australia: Beverley (1969), Honeymoon (1972), Olympic Dam (1975), and in Northern Territory: Ranger (1969), Nabarlek (1970), Koongarra (1970) and Jabiluka (1971). These and other discoveries have led to substantial additions to Australia's reasonably assured uranium resources which now total 474,000 tonnes of uranium recoverable at less than US$80 per kg U.

The Mary Kathleen mine which had ceased operations in 1963, opened again in 1976. After mining and treating sufficient ore to meet its contractual commitments, the mine was closed in 1982.

The Ranger mine was authorised under Section 41 of the Atomic Energy Act in 1979, and commercial production at a planned rate of 3,000 tonnes yellowcake (U_3O_8) per annum commenced in late 1981. Development approval for the Nabarlek deposit was granted in early 1979 and mining commenced later that year. Production at a planned rate of 1,000 tonnes U_3O_8 per annum, commenced in 1981.

Following the election of a new Government in 1983 a complete review of all aspects of Australia's policies as they relate to uranium was instituted. This process was completed in November 1983, at which time the Government announced its policy on uranium.

The policy provides for the continuing operation of the existing Ranger and Nabarlek mines in the Northern Territory and the development of the Olympic Dam copper-uranium-gold deposit in South Australia. No other uranium mines will be permitted to proceed, but existing mines and the Olympic Dam project will be allowed to negotiate new contracts.

All future exports of Australian uranium will be subject to the most stringent supply conditions to be determined following consideration of a Report prepared by the Australian Science and Technology Council on Australia's role in the nuclear fuel cycle. The Report is currently being considered by the Government. In addition, exports of Australian uranium to France will not be permitted until France ceases testing nuclear weapons in the South Pacific Region.

All uranium produced in Australia is exported in the form of yellowcake for use in nuclear reactors for the generation of electricity, and for the production of radioisotopes and radiopharmaceuticals. Australia's two producers have contracts with utilities in Japan, the Federal Republic of Germany, Republic of Korea, Finland, Sweden, Belgium, France and the USA.

Contract tonnages for the period 1977-1996 exceed 55,000 tonnes U_3O_8. Exports for 1983-84 amounted to almost 3,300 tonnes U_3O_8 valued at nearly $A311m.

The Australian Atomic Energy Commission (AAEC), was established as a statutory body by the Commonwealth Parliament under the *Atomic Energy Act 1953*.

The AAEC's activities are controlled by a Commission which is responsible to the Minister for Resources and Energy. *The Atomic Energy Act* provides for the Commission to consist of five Commissioners including a Chairman.

Moving in its earliest days towards the planning and construction of a nuclear research establishment at Lucas Heights near Sydney, the Commission arranged for a nucleus of scientists and engineers to obtain training and experience through overseas attachments, mainly in the United Kingdom. By the late 1950's a research and development (R&D) program had been initiated at its research establishment.

The AAEC's current nuclear program includes radioisotope production and applications, environmental science (particularly in relation to uranium mining activities), provision of support for regulatory and international operations and waste management studies. The latter involves the construction of a non-radioactive pilot plant for the manufacture of full-sized blocks of SYNROC (a synthetic rock-like material used to immobilise high level radioactive waste from reactors). The AAEC is also participating in co-operative research programs with both Japan and the UK to investigate the properties of SYNROC and its abilities to immobilise high level waste.

The programs, structure and functions of the AAEC are currently under review. Particular attention is being given to ensuring that the functions and programs of the AAEC are appropriate to national requirements.

Current expenditure by the AAEC is of the order of $35 million a year. Staff totals some 1,060 professional, technical, trade, administration and support personnel.

The AAEC participates in the activities of the Australian Institute of Nuclear Science and Engineering. The Institute, which has a corporate membership comprising the Commission and the Australian universities, is concerned with the awarding of studentships, fellowships and research grants, with the organising of conferences and with arranging the use of AAEC facilities by research workers within the universities and colleges of advanced education. The Australian School of Nuclear Technology, located at Lucas Heights, is a joint enterprise of the AAEC and the University of New South

Wales. Courses are provided regularly on such subjects as radio-nuclides in medicine, radiation protection and nuclear technology. Participants have been drawn from Australia, New Zealand, Asia, Africa, Papua New Guinea and the Pacific region.

The Atomic Energy Act is the principal Commonwealth legislation in the nuclear field. As well as being the legislative basis for the AAEC, the Act provides for Commonwealth powers over uranium and nuclear materials, it was also used as the basis for the authorisation of the Ranger Uranium Mine.

The Government's policy is to replace the Atomic Energy Act with new legislation for the AAEC, and to give effect to Australia's international nuclear non-proliferation and safeguards obligations.

For further details relating to the production of uranium in Australia see Chapter 16, Mineral Industry.

Thorium

Thorium is a radioactive mineral that is about three times as abundant as uranium, but occurs in fewer geological environments and in lower grade accumulation. Most of the world's resources occur in monazite, a complex phosphate recovered primarily for its rare-earth content. Primary thorium minerals are resistant to oxidation and form economically important place deposits as well as hard-rock deposits.

In Australia, monazite is produced from titanium-bearing mineral sands on the east and west coasts. Other thorium occurrences are known, but are uneconomic. Australia currently supplies about two-thirds of the world's monazite requirements.

Exports from Australia of thorium and thorium-containing ores require the approval of the Minister for Trade under the Customs (Prohibited Exports) Regulations.

Solar energy

Solar radiation is measured continuously on a routine basis by the Bureau of Meteorology at 28 stations throughout Australia. These stations also supply data on air temperatures, dewpoint and wind.

Like wind, and tidal and wave energy, solar energy is inexhaustible and shares with these energy sources a number of properties which make it both difficult and costly to collect, store and transform into useful work. The particular properties are low intensity, geographic, seasonal and daily variations.

The use of solar energy for domestic hot water supply is well established commercially in Australia and the solar hot water systems industry production now has a value of about $44 million per annum. With a view to industrial application, advanced collectors have been designed which can produce steam. Currently however, there appear to be few applications of solar energy which are economically attractive to industry.

The use of passive solar design principles in housing is increasing as relatively low cost passive designs are developed. In the area of electricity generation, photo-voltaics are already viable in some small-scale specialist applications, for example, in navigation and communications stations. If costs are reduced, solar electricity may be increasingly used in the future, for remote homestead or community power supplies and for pumping of water. Solar cooling is not economic at this stage owing to high capital costs and low efficiencies.

Ocean thermal energy

In Australia, there has been virtually no assessment of the potential of the ocean thermal energy source made. It has been suggested that tropical waters such as those off the Queensland coast would be suitable, but power generated from this area would be of considerable distance from the major power consumers in the south, and therefore unable to compete with coal based electricity.

Wind energy

Using data from Bureau of Meteorology wind stations, CSIRO has undertaken a continental wind assessment of Australia. In addition, a number of site specific wind resource assessments have been carried out by CSIRO and other bodies. Broadly, these studies indicate that while the bulk of the Australian inland has relatively low average windspeeds, some coastal and island localities have favourable wind energy resources, notably on the Western Australian, South Australian and Tasmanian coasts, in Bass Strait and on Lord Howe Island.

At present the use of wind energy in Australia is confined principally to mechanical windmills for water pumping and small wind electricity generators for remote areas.

It is unlikely that wind energy will be able to compete on a widespread and large scale with coal for electricity generation in Australia, but where wind resources are favourable, wind turbines could find increasing application in remote areas which currently rely on diesel fuel for electricity production.

Two imported machines in the 20-55 kW range are currently being demonstrated on Rottnest Island in Western Australia, and another imported 55 kW machine is operating at Ballarat in Victoria. At the same time, two Australian manufactured wind turbines are also being demonstrated, one 60 kW capacity machine at Fremantle in Western Australia, the second, a 16 kW machine at Wodonga in Victoria.

Geothermal energy

Most of Australia's geothermal resources are of conduction-dominated type. A most extensive and well documented study in Australia of subsurface temperatures has been made in bore-holes in the Great Artesian Basin. In this basin, about 20 per cent of indexed water bores penetrate to depths greater than 1,000 m and since geothermal gradients are generally greater than 30°C/1,000 m, it is reasonable to assume that hot water can be obtained from such aquifers. Of the total number of indexed water bores, only a very small proportion have water temperatures greater than 100°C.

Australia's geothermal resources in other basins are probably comparable with that of the Great Artesian Basin, the extrapolation of flow rates and temperatures to other sedimentary basins suggests it to be geologically reasonable. Economic and technical difficulties indicate that in the foreseeable future the potential use of our geothermal resources will be largely restricted to hot water supply, for space heating and light industrial purposes.

In Australia, it has been estimated by the Bureau of Mineral Resources (BMR) that identified (demonstrated and inferred) geothermal resources are about 1 per cent of Australia's annual primary energy consumption. Undiscovered geothermal resources however may be many orders of magnitude greater than the above estimate.

Tidal energy

Tidal energy is a dispersed energy source derived from regular fluctuations in the combined gravitational forces exerted by the moon and the sun, at any one point on the earth's surface, as the earth rotates. The mean tidal range in the open ocean is about 1 metre, but under suitable hydraulic and topographical conditions, much higher tides than this build up in places around coasts, due to resonance. Because only two commercial tidal plants exist so far in the world, relatively little is known about the possible environmental impact of large-scale utilisation. It is unlikely, however, that tidal installations would be entirely without effect on the ecological life of bays and estuaries within their area of influence due, for instance, to silting and concomitant dredging.

Around Australia there are theoretically very large amounts of tidal energy available, especially on the north-west coast where the tidal range is as great as 11 metres and where the topography is suitable. The tidal potential of this region has been the subject of a series of investigations, including one carried out in 1965 on one of the most promising sites at Secure Bay. It was concluded that a minimum of 12 years design and construction time would be required, although the cost of electricity at the site would be similar to that derived from conventional thermal stations. However, the long distances to potential markets result in a doubling of these electricity generation costs. Subsequent studies by the State Energy Commission of Western Australia have indicated that lead times and construction costs could be reduced but not sufficiently to make tidal energy economically attractive even if a suitable electricity consumer were nearby.

The likelihood of early exploitation of this resource would appear to be less than in other countries, if only because of the long distances involved in transmission to population centres. In Australia, the major consumer regions are located along coastlines where the tidal range is very small.

Biomass

Biomass includes crops, wood, agricultural and forestry residues and animal wastes. Currently only two forms of biomass are used significantly as energy resources in Australia. These are firewood and bagasse, both converted to energy by direct combustion.

Approximately 2 megatonnes of firewood are used annually in Australia, equivalent in energy terms to 82.3 petajoules, or 2.6% of Australia's primary energy demand. Production is expected to remain stable at about this level through the 1980s.

Bagasse is the fibrous residue remaining after extraction of the juice from sugar cane. It is the major fuel used in the sugar industry, providing 68.5 petajoules or 2.2% of Australia's total primary energy demand.

Biomass also has a possible use as a source of liquid fuels for transport, particularly ethanol and methanol. Technologies are commercially available for converting biomass to liquid fuels. The major impediments to its current use are that it is not competitive with conventional fuels and generally vehicle modifications are necessary for satisfactory operation.

In 1979, the CSIRO completed a survey of the potential for the production of these fuels from agricultural and forestry resources in Australia. The resources considered were both new energy crops and forest plantations, as well as the residues from existing crop and forest production. In estimating

potential new crop production, it was assumed that all land with suitable climate, soil and terrain for an energy crop would be available for energy farming except land at present under crops or sown pastures. The total biomass resources considered could provide a net liquid fuels output of 460 petajoules, 65% of the energy used as liquid fuel in transport in 1977-78. This is a net figure taking into account the liquid fuel used in production. It does not take into account socio-economic considerations such as more profitable or socially desirable uses of the land available for new crops. It must be considered as an upper limit only.

Recent studies have shown that, largely as a result of the cost of production of the feedstocks, liquid fuel from biomass is at a major economic disadvantage compared to petroleum-based fuels, and is unlikely to be commercialised on a significant scale in the near future.

Electric power

Responsibility for public electricity supply rests with the State Governments which control electricity production and distribution through public authorities. The Commonwealth Government's major direct role in the electricity supply industry is its responsibility for the Snowy Mountains Scheme. Greater descriptive and historical detail about the various systems is contained in earlier issues of the Year Book.

Hydro-Electric Resources

With the exception of Tasmania, Australia is generally not well-endowed with hydro-electric resources because of low average rainfall and limited areas of high relief. Major hydro-electric potential is confined to Tasmania and the Great Dividing Range areas of Victoria, New South Wales and Queensland, with some small potential on rivers draining into the Timor Sea in Western Australia and the Northern Territory.

The practical potential of hydro-electric power in Australia has been estimated at 24,000 gigawatt hours (GWh) per year, of which about 60% has currently been developed. In 1982/83, hydro-electric generation of 12,857 GWh was down on the previous year owing to drought conditions.

At 30 June 1983 the installed hydro-electric generating capacity of 6,332 megawatts (MW) represented 23% of total installed capacity.

Future hydro development will be mainly limited to environmentally acceptable sites in Tasmania, and to a lesser extent North Queensland, as most of the low cost resource elsewhere has already been developed. Although hydro-electric power stations will continue to be constructed into the 1990s and probably beyond, hydro's share of total generation will decline as increasing load is met mainly by coal-fired power stations.

Snowy Mountains Hydro-Electric Scheme

The Snowy Mountains Scheme is a dual purpose complex which supplies water for generation and irrigation. It is located in south-eastern Australia, and on its completion was one of the largest engineering works of its type in the world. It impounds the south-flowing waters of the Snowy River and its tributary, the Eucumbene, at high elevations and diverts them inland to the Murray and Murrumbidgee Rivers through two tunnel systems driven through the Snowy Mountains. The Scheme also involves the regulation and utilisation of the headwaters of the Murrumbidgee, Tumut, Tooma and Geehi Rivers. The diverted waters fall some 800 metres and together with regulated flows in the Geehi and Tumut River catchments generate mainly peak load electricity for the States of New South Wales, Victoria and the Australian Capital Territory as they pass through power stations to the irrigation areas inland from the Snowy Mountains.

The operation and maintenance of the Scheme is directed by the Snowy Mountains Council which was established in 1959 following an agreement between the Commonwealth, New South Wales and Victorian Governments. The Commonwealth Government reserves 670 GWh of the Scheme's output for supply to the Australian Capital Territory, the remainder being shared between the States of New South Wales and Victoria in the ratio 2:1.

The Snowy Mountains Hydro-Electric Scheme was designed and constructed by the Snowy Mountains Authority which was established by the *Snowy Mountains Hydro-Electric Power Act 1949*. It was completed in 1974 and has an installed capacity of 3,740 MW and an annual average energy output of over 5,000 GWh. An average of 2,300 GL of water per year has become available for irrigation in the Murray and Murrumbidgee rivers as a result of the Scheme.

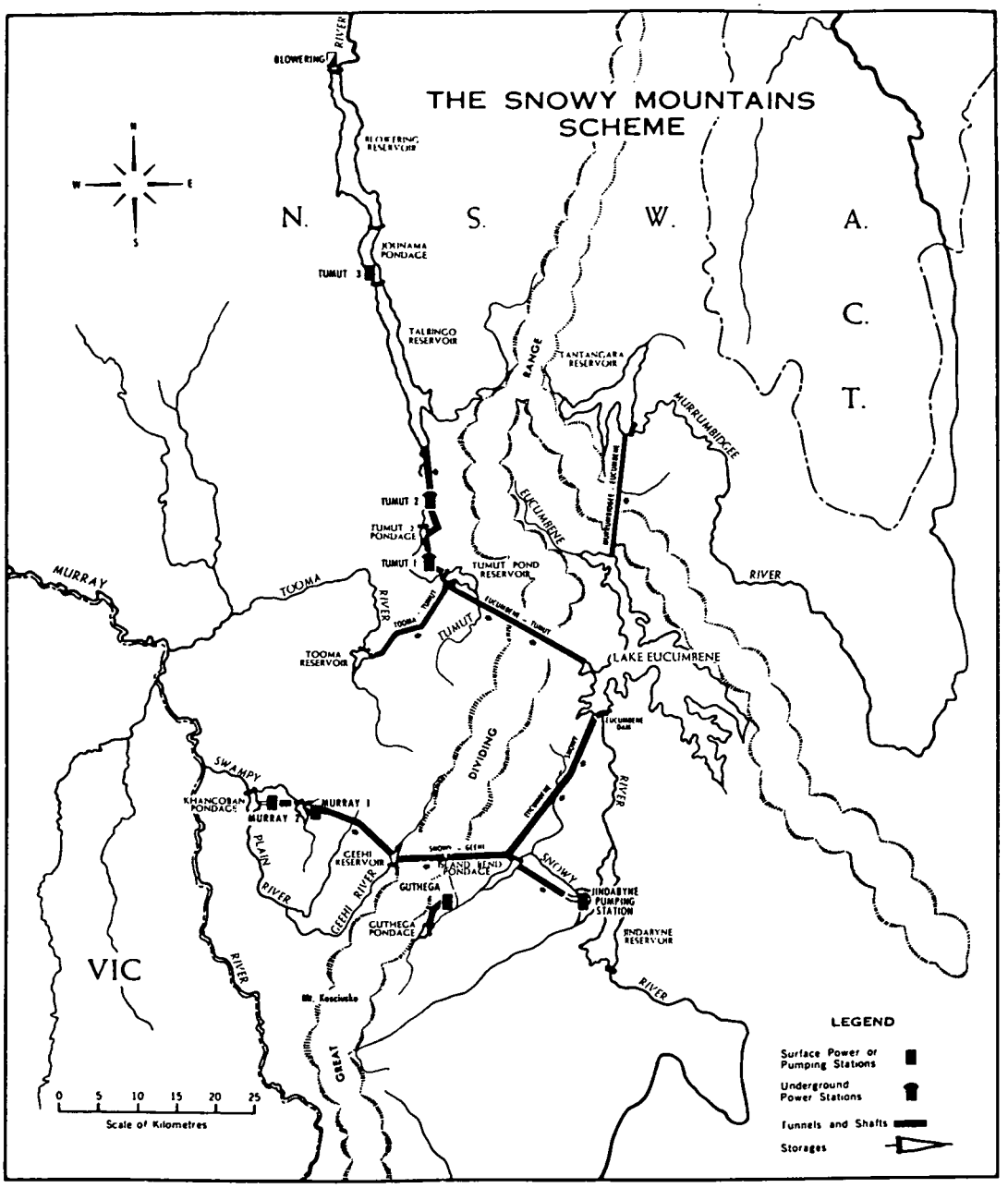

THE SNOWY MOUNTAINS SCHEME
N. S. W. A. C. T.
VIC
BLOWERING RIVER
BLOWERING RESERVOIR
KOXINAMA PONDAGE
TUMUT 3
TALBINGO RESERVOIR
TANTANGARA RESERVOIR
MURRUMBIDGEE RIVER
TUMUT 2
TUMUT 2 PONDAGE
TUMUT 1
TUMUT POND RESERVOIR
TUMUT
EUCUMBENE
MURRAY
TOOMA
TOOMA RIVER
TOOMA RESERVOIR
LAKE EUCUMBENE
EUCUMBENE DAM
DIVIDING RANGE
SWAMPY PLAIN RIVER
KHANCOBAN PONDAGE
MURRAY 1
MURRAY 2
GEEHI RESERVOIR
GEEHI RIVER
ISLAND BEND PONDAGE
GUTHEGA
SNOWY
JINDABYNE PUMPING STATION
JINDABYNE RESERVOIR
GUTHEGA PONDAGE
Mt. Kosciusko
GREAT
0 5 10 15 20 25
Scale of Kilometres
LEGEND
Surface Power or Pumping Stations
Underground Power Stations
Tunnels and Shafts
Storages

PLATE 42

Electricity generation and transmission

The following table shows details of thermal and hydro electricity generated in Australia during recent years.

ELECTRICITY (*a*)—THERMAL AND HYDRO

Year	*Million kWh*
1977-78	86,095
1978-79	90,857
1979-80	95,910
1980-81	100,782
1981-82	104,975
1982-83	105,933

(*a*) Figures represent estimates of total electricity generated by public utilities, factories generating for their own use, and factories supplying electricity for domestic and other consumption.

NEW SOUTH WALES

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 1983 there were 28 retail supply authorities throughout the State, comprising 23 electricity county councils (consisting of groups of shire and/or municipal councils), 1 city council, 1 shire council, and 3 private franchise holders.

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 175 cities, municipalities and shires in New South Wales, 172 are included in one or other of the 23 electricity county districts.

The Energy Authority of New South Wales

The *Electricity Development Act* 1945, confers broad powers on the Energy Authority to coordinate and develop the public electricity supply industry. The functions of the Authority include the promotion of the wise use of electricity, 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 the standardising of materials and equipment.

The Authority continues to administer the Rural Electricity Subsidy Scheme which terminated on 30 June 1982. Under the scheme, the rural electrical development of the State has now been virtually completed in areas where the extension of supply is economically feasible. Local electricity suppliers receive subsidies from the Authority towards the cost of new rural lines. At 30 June 1984 the Authority was committed to the payment of $46,924,963 in subsidies, of which $40,455,256 had been paid. Further details of the operation of the scheme are given in Year Book No. 56, page 956.

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 road accidents at night. Since the introduction of the scheme in 1964, subsidy has been approved in respect of some 1,993 kilometres of traffic routes throughout the State.

Generation and transmission

Of the State's electrical power requirements during the year ended 30 June 1983, almost all was generated in New South Wales (89.8 per cent by thermal fired power stations, 5.9 per cent from the Snowy Mountains Hydro-Electric Authority and 0.9 per cent by other hydro-electric stations). The remaining 3.4 per cent was supplied by various sources, including interchange with other States and other small generating authorities in New South Wales.

Major generating stations. At 30 June 1983 the major power stations of the State system of the Electricity Commission of New South Wales and their nominal capacities were as follows: Liddell (Hunter Valley), 2,000 MW; Munmorah (Tuggerah Lakes), 1,400 MW; Vales Point (Lake Macquarie), 2,195 MW; Eraring, 1,320 MW; Wallerawang (near Lithgow), 1,240 MW. The total nominal capacity of the Electricity Commission's system as at 30 June 1983 was 9,851 MW. The greater part of the Commission's generating plant is concentrated within a hundred and eighty-five kilometre 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 500 kV, 330 kV, 132 kV, 66 kV and some 33 kV transmission lines links the Commission's power stations with the load centres throughout the eastern portions of the State, extending geographically over 650 kilometres inland.

At 30 June 1983 there were in service, 3,940 circuit kilometres of 330 kV, 7,328 kilometres of 132 kV transmission lines and 282 kilometres of 500 kV transmission lines. There were also in service 5,424 kilometres of transmission line of 66 kV and lower voltages, and 517 kilometres of underground cable. The installed transformer capacity at the Commission's 174 substations was 28,888 MVA.

Separate systems and total State installed capacity. Several local government bodies operate their own power stations and generate a 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 13.1 MW), the North-West County Council (15.75 MW) and the New England County Council (57 MW). The aggregate effective capacity for the whole of New South Wales systems and isolated plants was approximately 9,880 MW at 30 June 1983, while the number of ultimate consumers at this date was 2,130,945.

Future developments

Future projects include the installation of 5,280 MW of coal-fired generating plant. Two additional 660 MW units are being installed at Eraring Power Station on the central coast and will be commissioned progressively for full commercial service over the period 1983-1984. At Bayswater Power Station, which is situated in the Hunter Valley, construction has commenced on four 660 MW units. Two 660 MW units are also planned for Mount Piper Power Station which is located on the western coalfield near Wallerawang. Commissioning of the Bayswater units is planned between 1985 and 1987 with Mount Piper to follow at a later date.

Construction of a double circuit 500 kV transmission line between Eraring and Kemps Creek, west of Sydney is complete. This transmission line is initially operating at 330 kV but operation at 500 kV is planned early in 1984. A double circuit 500 kV transmission link will be constructed from Bayswater Power Station to Mount Piper Power Station and thence to Marulan where it will be interconnected with the existing transmission system between the Snowy Mountains and Sydney.

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 394). Apart from this area, major hydro-electric stations are in operation at the Warragamba Dam (50 MW) and Hume Dam (50 MW). In addition, there are six smaller hydro-electric installations in operation in various parts of the State. A pumped-storage hydro-electric system to produce 240 MW has been installed as part of the Shoalhaven Scheme in conjunction with the Metropolitan Water Sewerage and Drainage Board.

VICTORIA

State Electricity Commission (SEC)

The SEC is Australia's largest electricity supply authority and individual coal producer. It is a semi-government authority with the principal responsibility of generating or purchasing electricity for supply throughout Victoria. It may own, develop and operate brown coal open cuts and briquetting plants and develop the State's hydro-electric resources. It is required to meet, from its own revenue, all expenditure involved with operating its power and fuel undertakings and to provide for statutory transfers to the consolidated revenue of the State. In 1983–84 its revenue was $1,401 million. At 30 June 1984 it had total fixed assets of $6,807 million and a staff of 22,800.

The SEC was established by an Act of the Victorian Parliament in 1921 and now operates under the *State Electricity Commission Act 1958*. Since it began operating, the SEC has expanded and co-ordinated the generation, purchase and supply of electricity on a statewide basis to the stage where its system provides almost all the electricity produced in Victoria and its transmission covers almost the entire population of the State. At 30 June 1984 it distributed electricity directly to 1.39 million customers and indirectly to a further 278,500 through 11 metropolitan councils which buy power in bulk for retail distribution under franchises granted by the Victorian Government before the SEC's establishment.

Existing electricity system

The SEC Act requires the SEC to apply the natural resources of the State. Of the State's recoverable fossil fuel reserves, brown coal represents 94.6 per cent, natural gas 2.6 and oil 2.8. The SEC therefore has committed itself to increasing the proportion of total Victorian requirements met with coal-based energy.

Victoria's electricity system is based upon the State's extensive brown coal resource in the Latrobe Valley 140 to 180 km east of Melbourne in central Gippsland. It is one of the largest single brown coal deposits in the world, amounting to 108,000 megatonnes of which 35,000 are economically winnable.

The coal is young and soft with a moisture content of 60 to 70 per cent and occurs in thick seams from relatively close to the surface to a depth of several hundred metres. The coal can be won continuously in large quantities and at low cost by a specialised mechanical plant. The SEC's coal-fired power stations have been established near the coal deposits because the coal's moisture content would make the coal expensive to transport, every three tonnes of material including two tonnes of water.

The major brown coal-fired generating plants in the system are the 1,600 MW Hazelwood and 1,450 MW Yallourn 'W' power stations. Other brown coal-fired plants are Morwell (170 MW) and Yallourn 'C', 'D' and 'E' (521 MW). These stations are all located in the Latrobe Valley and generate three-quarters of the State's electricity requirement.

Other thermal stations are Jeeralang (465 MW) gas turbine station in the Latrobe Valley and Newport 'D' (500 MW) gas-fired station in Melbourne. There are hydro-electric power stations in north-eastern Victoria: Kiewa (184 MW), Dartmouth (150 MW), Eildon/Rubicon/Cairn Curran (137 MW). Victoria is also entitled to about 30 per cent of the output of the Snowy Mountains Hydro-Electric Scheme and half of the output of the Hume hydro-electric station near Albury.

The SEC's total installed generating plant capacity at 30 June 1984 was 6,827 MW, including both capacity within the State and that available to it from New South Wales. In 1983–84 electricity generated by the SEC in its thermal and hydro-electric power stations and purchased totalled 25,752 GWh.

Power station construction

Construction of the Loy Yang 'A' power station complex south-east of Traralgon in the Latrobe Valley was authorised by the Victorian Government in 1976. It is the largest single engineering project undertaken in Australia. Coal-fired, Loy Yang will provide base load electricity for the Victorian grid and almost double the State's generating capacity. The project nominally comprises two 2,000 MW power stations, Loy Yang 'A' and Loy Yang 'B' in eight 500 MW units. The first unit was due to come into service in 1984.

Transmission and distribution

The distribution of electricity throughout Victoria has been completed, except for some isolated and remote areas of the State. Main transmission is by 500, 330, 220 and 66 kV transmission lines which supply the principal distribution centres and interconnection between generating sources.

Three 500 kV transmission lines, Australia's first, and six 220 kV lines link the Latrobe Valley stations with Melbourne and the State grid while three 330 kV lines provide the interstate link, two through the Snowy scheme. Bulk distribution of power throughout the main regional areas is by 220 kV lines to terminal stations which reduce the voltage to 66 kV or 22 kV for delivery to zone substations for further distribution. Feeder lines then deliver to distribution substations which in turn reduce the voltage to 415/240 volts for reticulation to individual customers. Some big industrial concerns take power at higher voltages.

Major development of the transmission system in 1983–84 included the completion of the first and second 500 kV lines from Loy Yang power station to Hazelwood terminal station. Construction is in progress on a 220 kV line between Moorabool, near Geelong, and Ballarat. Construction is also in progress on a 500 kV line between Sydenham and South Morang to reinforce supply to the western area of the State.

QUEENSLAND

Organisations

The State Electricity Commission of Queensland's main functions are to plan and ensure the proper development and co-ordination of the electricity supply industry throughout the State; to enforce safety regulations; to control electricity charges; to raise capital for development and to administer the *Electricity Act* 1976-1982 which regulates the electricity supply industry in Queensland.

The Queensland Government has decided to amalgamate the functions of the Commission and the Queensland Electricity Generating Board. Enabling legislation is to be introduced as soon as possible, however, as an interim measure the Government has dissolved the Generating Board and appointed the Commission to perform the duties of that Board.

The Queensland Electricity Generating Board is responsible for generation and main transmission. It operates the State's major power stations, and supplies, via its statewide transmission network, energy in bulk to the seven distributing boards whose responsibility it is to distribute electricity to consumers in their respective areas. These boards are the South East Queensland Electricity Board; the South West Queensland Electricity Board; the Wide Bay—Burnett Electricity Board; the Capricornia Electricity Board; the Mackay Electricity Board; the North Queensland Electricity Board and the Far North Queensland Electricity Board.

Four of these distributing boards (the South West Queensland, the Capricornia, the North Queensland and the Far North Queensland) also operate small internal combustion stations in their respective areas.

Electricity generation, transmission and distribution

During 1983-84 over ninety-six per cent of the State's generation of 17 084 million kilowatt hours (k.W.h) was derived from coal fuelled steam power stations. Due to the low rainfall in their catchment areas, the hydro-electric stations located in North Queensland only provided 2.6 per cent of the State's electricity needs. The remainder was produced by gas turbine and internal combustion generation using light fuel oil and natural gas. In addition to this public supply authority generation, a further 176 GW.h was purchased from other producers of electricity for redistribution to customers.

At 30 June 1984 the total generating capacity of the publicly-owned stations in the State was 4,216 MW, comprising 3,596 MW of coal fired steam plant, 382 MW of hydro-electric plant, 178 MW of gas turbine plant and 60 MW of internal combustion plant.

The following table lists the regional locations, types and capacities of major publicly-owned power stations in Queensland.

QUEENSLAND POWER STATIONS—CAPACITY AND TYPE, 30 JUNE 1984

(*Source*: Department of Resources and Energy)

Location	*Type*	*Capacity (MW)*
	SOUTHERN REGION	
Swanbank A	Steam	396
Swanbank B	Steam	480
Swanbank C	Gas turbine	30
Tennyson	Steam	240
Bulimba	Steam	180
Middle Ridge	Gas turbine	60
Tarong	Gas turbine	15
Tarong	Steam	350
Wivenhoe	Hydro (pumped storage)	250
	CENTRAL REGION	
Gladstone	Steam	1,650
Gladstone	Gas turbine	14
Callide	Steam	120
Rockhampton	Gas turbine	25
	NORTHERN REGION	
Kareeya	Hydro	72
Barron Gorge	Hydro	60
Collinsville	Steam	180
Mackay	Gas turbine	34

The electricity transmission and distribution system within the State comprised 138,160 circuit kilometres of electric lines and at 30 June 1984 supplied approximately 946,700 customers. The main transmission voltages are 275 kV, 132 kV, 110 kV, 66 kV and in certain areas 33 kV and 22 kV. The single wire earth return system is used extensively in rural electrification and 40,816 kilometres of line for this system of distribution was in service at 30 June 1984.

Future development

A programme is being maintained to construct four power stations to ensure adequate electricity supply well into the next decade. The first of these that will be completed is the Wivenhoe Pumped Storage Hydro Electric project. One of its two 250 MW pump/turbine generating units has already been commissioned and the other is expected to be operating later this year.

Tarong Power Station comprising four 350 MW steam and one 15 MW gas turbine generating units is expected to be fully commissioned by November 1986. The on-line capacity of the station was increased during the year when the first 350 MW steam unit joined the previously commissioned gas turbine unit in supplying electricity to the State grid. The second and third steam units are due to be on-line by May 1985 and February 1986 respectively. Included in this project is the construction of 331 route kilometres of 275 kV transmission lines and the installation of 2 000 MV.A of transformer capacity.

The next power station due for completion will be the Callide "B" project comprising two 350 MW generating units and will require the construction of 290 route kilometres of 275 kV transmission lines and the installation of 800 MV.A transformer capacity. The first set is expected to be commissioned in March 1988 and the second set one year later.

The fourth power station in the programme, the Stanwell Power Station, will consist of four 350 MW generating units. While no final commitment has been made on the start up date of its first unit, flexibility in scheduling of work and major contracts is being maintained to allow commencement of generation by as early as March 1990.

SOUTH AUSTRALIA

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; arrange, by agreement with other organisations which generate or supply electricity, 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 1983, the Electricity Trust operated a plant with a capacity of 2,090 MW, making it the most important authority supplying electricity in the State. There were approximately 584,000 ultimate consumers of electricity in the State, of whom 575,295 were supplied directly and approximately 9,200 indirectly (i.e. through bulk supply) by the Trust. Its major steam stations are Osborne (240 MW), Port Augusta Playford 'A' (90 MW) and Playford 'B' (240 MW), and Torrens Island (1,280 MW). The Trust also operates a turbo-generator station at Dry Creek (156 MW), a small station at Port Lincoln (9 MW), and one at Snuggery (75 MW).

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

Future developments

To meet future demands, a Northern Power Station comprising two 250 megawatt turbo-generators and boiler units is being constructed on a site near the existing power station at Port Augusta and will be commissioned before 1987.

The preferred strategy of the Advisory Committee on Future Electricity Generation Options is:

- to implement an opportunity energy interconnection with the Victorian NSW system, for commissioning in 1989;
- to review in late 1985 the economics and need for an interim supply source in 1990. The review to be based on a third unit at the Northern Power Station, contract supply from Victoria, or conversion of 400 megawatts at Torrens Island to coal firing; or
- to implement a local lignite-fired station when feasible and required (on current indications, 1993). The South Australian Government is currently considering these options.

WESTERN AUSTRALIA

State Energy Commission of Western Australia

On 1 July 1975 the Government of Western Australia combined the State Electricity Commission and the Fuel and Power Commission to form a new organisation known as the State Energy Commission of Western Australia. The Commission is specifically charged with the responsibility for ensuring the effective and efficient utilisation of the State's energy resources and for providing its people with economical and reliable supplies of electricity and gas.

The Commission owns and operates four major thermal power stations. These are located at Kwinana, Muja, South Fremantle and Bunbury and all use local coal to produce electricity. Kwinana power station also has the capacity to burn oil or natural gas. A small hydro-electric station is situated at Wellington Dam near Collie, and there are gas turbine generating units at Geraldton and Kwinana.

Power from the four major stations is fed to an interconnected grid system which supplies the electricity needs of 98 per cent of the State's population. The grid services the metropolitan area and the South West and Great Southern areas, including an area extending eastwards to Kalgoorlie and northwards as far as Kalbarri, some 100 km north of Geraldton. Kalgoorlie was brought into the south-west grid system in 1984 following construction of a 680 km transmission line from Muja, one of the longest radial feed lines constructed in Australia.

In areas too remote to utilise the interconnected grid system, diesel power stations are used. The Commission owns and operates 10 of these diesel stations. Of the remaining stations, 22 are owned by local authorities but operated by the Commission under the Country Towns' Assistance Scheme (CTAS).

The CTAS was introduced when steeply rising oil prices in the 1970s caused dramatic increases in country electricity prices. Under this scheme, the Commission operates the electricity undertakings but ownership remains with the shires which are required to raise the funds needed for capital works, including generating plant, distribution extensions and upgrading.

In areas supplied with power through the interconnected grid, or Commission owned and/or operated diesel power stations, uniform tariffs apply.

At 30 June 1983 the Commission's generating capacity from its interconnected grid system was 1782 MW, while the capacity of its supply system in country areas was 98.58 MW.

TASMANIA

A considerable part of the water catchment in Tasmania is at high level. The establishment of numerous dams has created substantial artificial storage which has enabled the State to produce energy at a lower cost than elsewhere in Australia and 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. Abundant and comparatively cheap supplies of electricity played an important role in attracting industry to Tasmania. 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

The Commission was created in 1930, taking over the activities of the Hydro-Electric Department and the existing small hydro-electric installations. Development initially concentrated on hydro-electric generation feeding into a State-wide power grid (King Island from 1951 and Flinders Island from 1968 are outside the grid and are supplied by diesel generators).During 1967 the construction of a substantial oil fired thermal station with a capacity of 240 MW was approved, as a supplement to the continuing hydro development programme.

Output and capacity of hydro-electric system

At 30 June 1984 the generating system had an installed capacity of 1940 MW. The approved remaining works at the Pieman River Power Development, scheduled for completion in 1986, will increase the system installed capacity to 2171 MW.

Work began in 1982-83 on the Gordon River Power Development Stage 2 but was halted by the Federal government refusing consent for the project to proceed.

The Hydro-Electric Commission in August-September 1983 began work on two smaller hydro power schemes in Western Tasmania. These are the King River Power Development scheduled for completion in mid 1990 and the Anthony Power Development which is expected to be commissioned 18 months later. They will add about 236 MW to the installed capacity of the system.

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. The Authority's electricity supply requirements are met by a Snowy Mountains reservation of 670 GWh and the balance is provided by the Electricity Commission of New South Wales. The locally-owned plant consists of 3 MW diesel alternators which are retained as a standby for essential supplies. The total number of ultimate consumers at 30 June 1984 was 87,928. During the year 1983–84 the bulk electricity purchased was 1,677.311 GWh and the system maximum demand was 465.9 MW.

NORTHERN TERRITORY

The Northern Territory Electricity Commission is a Statutory Authority operating under the *Northern Territory Electricity Act* 1978 (as amended to date), with responsibility for generation, distribution, transmission and sale of electricity in the Northern Territory. The Commission's responsibilities also include electrical safety and inspections.

In Darwin, the major electricity supply source is Stokes Hill Power Station, with an installed capacity of 141 MW, and standby gas turbines are located at Berrimah and Snell Street, with a combined capacity of 40 MW.

In Alice Springs, the Territory's second largest town, the power is generated at Ron Goodin Power Station with a capacity of 42.2 MW, of which 26 MW either is operating on gas fuel or is converted to gas operation. Other Territory centres where power is generated by the Northern Territory Electricity Commission are diesel generating stations using distillate fuel.

A proposal to pipe gas from the Amadeus Basin near Alice Springs to Darwin is currently being investigated.

If accepted, this proposal will mean that those towns located on the Stuart Highway will change to gas fuel. These are: Tennant Creek with an installed capacity of 9.6 MW, Katherine with an installed capacity of 14.4 MW, and the proposed power station for Channel Island.

Many small communities in the Territory generate their own power using diesel fired generating sets. While the Department of Transport and Works presently has the responsibility for these power stations, it is proposed that this responsibility be transferred to the Northern Territory Electricity Commission.

Electricity and gas establishments

The census of electricity and gas industries covers distribution as well as production and is conducted as a component of the ABS's integrated economic statistics system. This system has been developed so that data from each industry sector conform to the same basic conceptual standards thereby allowing comparative analysis between and across different industry sectors. The results of this census are therefore comparable with economic data collections undertaken annually for the mining and manufacturing industries and periodically for the retail and wholesale trade, construction, transport and selected services industries.

The following table shows a summary of operations of electricity and gas establishments for 1982–83. Further details are available in the publication *Electricity and Gas Establishments: Details of Operations, Australia, 1982–83* (8208.0)

ELECTRICITY AND GAS ESTABLISHMENTS—SUMMARY OF OPERATIONS, 1982–83

State or Territory	*Establishments at 30 June*	*Employment at 30 June*			*Wages and salaries*	*Turnover*	*Stocks*		*Purchases, transfers in and selected expenses*	*Value added*	*Fixed capital expenditure less disposals*
		Males (No.)	*Females (No.)*	*Total (No.)*	*($'000)*	*($'000)*	*Opening ($'000)*	*Closing ($'000)*	*($'000)*	*($'000*	*($'000)*
New South Wales											
Electricity	34	27,829	2,818	30,647	661,855	3,732,051	281,875	371,583	2,097,975	1 723,785	920,384
Gas	22	2,501	568	3,069	54,086	322,761	24,632	34,577	194,385	138,322	24,070
Queensland											
Electricity	11	11,363	1,455	12,818	256,848	1,454,072	75,708	124,262	850,388	652,238	598,416
Gas	8	609	114	723	11,385	75,831	6,833	6,195	41,615	33,579	7,514
Other States and Territories (*a*)											
Electricity	40	36,268	2,977	39,245	780,757	3,289,702	172,191	174,279	1,341,771	1,950,017	1,433,784
Gas	7	5,903	889	6,792	140,928	759,480	27,248	31,349	309,483	454,096	448,818
Australia											
Electricity	85	75,460	7,250	82,710	1,699,460	8,475,825	529,774	670,124	4,290,134	4,326,040	2,952,584
Gas	37	9,013	1,571	10,584	206,399	1,158,072	58,713	72,121	545,483	625,997	480,402

(*a*) Includes Victoria, South Australia, Western Australia, Tasmania, Northern Territory and Australian Capital Territory. At the end of June 1983 the number of establishments were: Victoria electricity 14, gas 1; South Australia - electricity 12, gas 2; Western Australia—electricity 9, gas 2; Northern Territory—electricity 2 and Australian Capital Territory electricity 1, gas 1.

National Energy Survey

In June 1983 the ABS conducted a survey throughout Australia to obtain information relating to the numbers and types of selected domestic appliances held by households. Details were also sought from the relevant energy supplying authorities on the consumption of electricity and reticulated gas by households for the most recent 12 month period available.

The survey was conducted as part of the regular ABS population survey, which is based on a multi-stage area sample of private dwellings (houses, flats, etc.) and non-private dwellings (hospitals, hotels, motels, etc.) and covers about two-thirds of one per cent of the population of Australia.

For the purposes of this National Energy Survey certain types of dwellings were excluded, such as non-private dwellings, caravan parks, dwellings occupied by more than one household, and dwellings occupied by diplomatic personnel and by overseas residents. The survey identified a small number of households without electricity, and these were also excluded.

For each State a magnetic tape file is now available containing information from the National Energy Survey. An example of consumption data available is shown in the following table on Average Consumption of Reticulated Gas and Electricity by Households, by State and Capital City.

Further data relating to the survey can be found in ABS publications listed in the Bibliography at the end of this chapter.

AVERAGE CONSUMPTION OF RETICULATED GAS AND ELECTRICITY BY HOUSEHOLDS, BY STATE AND CAPITAL CITY(*a*), 1982–83

	Households with reticulated gas			*Households without reticulated gas*			
		Average annual consumption					
	Number of households	*Gas*	*Electricity*	*Number of households*	*Average annual consumption of electricity*	*Total households*	*Average annual electricity consumption*
	('000)	(MJ)	(MJ)	('000)	(MJ)	('000)	(MJ)
New South Wales	391.3	16,059	16,807	1,370.9	26,746	1,762.2	24,539
Sydney	*327.7*	*15,438*	*17,027*	*809.4*	*27,023*	*1,137.1*	*24,143*
Victoria	824.1	53,688	17,146	469.8	28,076	1,293.9	21,115
Melbourne	*707.1*	*54,620*	*17,437*	*214.7*	*27,761*	*921.8*	*19,842*
Queensland	102.4	9,570	14,314	678.0	23,275	780.5	22,099
Brisbane	*93.5*	*9,559*	*14,414*	*273.4*	*24,210*	*366.9*	*21,714*
South Australia	218.1	25,801	15,036	245.5	27,494	463.6	21,632
Adelaide	*206.9*	*25,861*	*15,105*	*128.2*	*28,245*	*335.1*	*20,132*
Western Australia	135.0	16,671	12,521	300.6	17,689	435.6	16,087
Perth	*129.4*	*16,796*	*12,607*	*188.8*	*18,146*	*318.2*	*15,893*
Tasmania (*b*)						138.0	33,861
Hobart (*b*)						*53.7*	*34,941*
Northern Territory (*b*)						33.3	27,295
Australian Capital Territory (*b*)						74.0	37,936

(*a*) Refers to Capital City Statistical Division. (*b*) Reticulated gas consumption not available.

BIBLIOGRAPHY

ABS Publications

Directory of ABS Energy Statistics (1107.0).
National Energy Survey: Household Appliances, Facilities and Insulation, Australia, June 1983 (8212.0).
National Energy Survey: Household Energy Consumption, Australia, June 1982–83 (8213.0).

Other Publications

Other organisations which produce statistics in this field include the Department of Resources and Energy, the Joint Coal Board, the Australian Institute of Petroleum, the Electricity Supply Association of Australia and the Bureau of Mineral Resources, Geology and Geophysics. State Government departments and instrumentalities also are important sources of energy data, particularly at the regional level, while a number of private corporations and other entities operating within the energy field also publish or make available a significant amount of energy information.