

Energy

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Energy is fundamental to Australia's standard of living and economic performance. It has an important role to play in restructuring Australia's economy and improving its competitiveness.

The Commonwealth Government has a significant involvement in the activities of the energy sector through its responsibility for the overall national interest, including the management of the national economy and the equitable distribution of national income. Its responsibilities for export policy and offshore petroleum activities have a major impact on specific development projects.

In 1988 Australia completed an energy policy review published as *Energy 2000 — A National Energy Policy Paper*.

The review highlighted three major energy policy objectives:

- to ensure that Australia's energy supplies are adequate and reliable;
- to achieve the most efficient and competitive domestic energy supply industry; and
- to maximise the export earnings of Australia's energy resources consistent with a need to meet overseas requirements for cost competitive energy resources and with environmental and other social objectives.

Australia is generally well placed to meet these objectives by the year 2000.

Australia has abundant reserves of coal, gas and uranium to meet both export and domestic demands. Given currently known resources, it can continue current production rates in these energy sources for 300 years (black coal only), 45 years, and 145 years respectively. In fact Australia is one of only five Organisation for Economic Cooperation and Development (OECD) countries that are net energy exporters. Australia is:

- the world's largest exporter of coal, accounting for around one-third of the world seaborne coal trade;
- a major uranium producer and exporter, accounting for about 10 per cent of western world production and a greater percentage of its uranium trade; and
- currently an exporter of Liquefied Petroleum Gas (LPG) and petroleum products, and a major exporter of Liquefied Natural Gas (LNG).

Estimates of Australia's demonstrated economically recoverable resources of energy as at December 1990 were:

Black Coal	51.1 Gt
Brown Coal	41.7 Gt
Natural Gas	941 TL
Uranium	469 kt
Crude Oil, Gas Condensate and LPG	491 GL

NOTE: Gt — gigatonnes; TL — teralitres; kt — kilotonnes; GL — gigalitres.

Source: Department of Primary Industries and Energy.

ENERGY RESOURCES

Black coal

Black coal is currently 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 the main centres of population.

Of Australia's identified reserves of black coal, currently estimated at 71 gigatonnes (Gt), about 51 Gt are considered to be economically recoverable. They 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, while small deposits are being worked in Western Australia, South Australia and Tasmania. Australian saleable black coal production in 1990–91 was 166.3 Mt.

For further details relating to the production of black coal in Australia see the chapter, Mineral Industry. Details about the nature and age of black coal deposits are given in *Year Book Australia 1980*.

Brown coal

Australia's measured and indicated resources of brown coal were estimated to be around 42 Gt at December 1990. The main deposits are located in Victoria's Latrobe Valley (over 39 Gt). 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, and as far

north as central Queensland. 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 of power generation, briquette and char manufacture.

Petroleum

See the chapter, Mineral Industry, for information on legislation and expenditure on petroleum exploration.

The prospects of further discoveries of petroleum in Australia are considered to be good, particularly in sedimentary basins off the north-west coast. Consistent with the existing pattern of discoveries, undiscovered oil is likely to be of the light, low sulphur type and more gas fields than oil fields should be found. Assessments by the Bureau of Mineral Resources, Geology and Geophysics indicate that there is an average probability of finding at least another 380 gigalitres (GL) (2,400 million barrels) of crude oil in Australia. This compares with demonstrated economically recoverable resources of 278 GL (1,749 million barrels) and demonstrated sub-economically recoverable resources of 27 GL (169.8 million barrels) as at December 1990.

PETROLEUM RESOURCES(a), JUNE 1990

<i>Basin</i>	<i>Crude oil</i>	<i>Gas condensate</i>	<i>LPG</i>	<i>Sales gas</i>
	GL	GL	GL	TL
Demonstrated economic resources(b)				
Gippsland (Vic.)	160	23	45	208
Carnarvon (WA)	73	78	50	640
Cooper/Eromanga (SA/Qld)	12	6	10	72
Amadeus (NT) and Bonaparte (WA/NT)	33	—	1	13
Perth (WA)	—	—	—	4
Bowen/Surat (Qld)	—	—	—	3
Canning (WA)	—	—	—	—
Otway (Vic.)	—	—	—	1
Total	278	107	106	941
Demonstrated sub-economic resources(c)				
Gippsland/Bass (Vic./Tas.)	12	3	—	24
Bonaparte (WA/NT)	7	7	12	158
Carnarvon (WA)	7	16	—	451
Cooper/Eromanga (SA/Qld)	—	3	6	44
Browse (WA)	—	32	33	465
Perth (WA)	—	—	—	—
Amadeus (NT)	—	—	—	7
Bowen/Surat/Adavale (Qld)	—	—	—	6
Bass (Tas./Vic.)	1	5	7	8
Otway (SA/Vic.)	—	—	—	—
Total	27	66	58	1,163

(a) Based on the McKelvey classification which subdivides 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 extrapolations 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.

Source: Department of Primary Industries and Energy.

Crude oil and condensate

Indigenous production in 1990-91 at 31,955 megalitres (551 thousand barrels per day) of crude oil and condensate was slightly lower than the record production in 1989-90 of 31,994. Production of crude oil from the Bonaparte Basin has continued to grow since production started in 1986-87. In 1990-91, the Bonaparte Basin produced 4,081 megalitres of crude oil, nearly 13 per cent of the total indigenous oil production. Production of crude oil from the Gippsland Basin accounts for 55 per cent of total indigenous crude oil production. The North West Shelf was the major producer of condensate during 1990-91 with 56 per cent of indigenous production sourced in that region.

Export volumes of crude oil and condensate increased by 44 per cent in 1990-91 compared with 1989-90, to 9,997 megalitres. The main markets were the United States, Singapore and New Zealand. Imports of crude oil and condensate increased by 15 per cent to 13,381 megalitres.

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 in relation to other liquid fuels because LPG has to be refrigerated or pressurised when transported and stored. LPG is an alternative transport fuel for high mileage vehicles in urban areas as well as a petrochemical feedstock and a traditional fuel.

Identified economically recoverable resources of LPG at December 1990 of 114,000 megalitres (ML) were concentrated in Bass Strait, the North West Shelf and the Cooper Basin.

Production of naturally occurring LPG in Australia in 1990-91 was 3,547 ML. The major contributors to this total were the Bass Strait fields (2,500 ML or 70% of total production) and the Cooper Basin (947 ML or 27% of total production). About 43 per cent of domestic LPG production is exported (1,540 ML in 1990-91), mainly to Japan. Domestic consumption of 2,850 ML in 1989-90 was met by 986 ML of product obtained from refineries, with supply shortfalls being met by naturally occurring product and imports.

PETROLEUM PRODUCTION

Year	Crude oil and condensate	LPG(a)	Natural gas
	ML	ML	GL
1982-83	22,069	2,909	11,654
1983-84	26,828	3,132	12,097
1984-85	30,956	3,864	12,963
1985-86	31,734	4,016	14,278
1986-87	31,503	3,927	14,683
1987-88	31,264	3,923	15,249
1988-89	28,255	3,763	15,772
1989-90	31,993	3,785	20,077
1990-91	31,955	3,547	21,109

(a) Naturally occurring.

Source: Department of Primary Industries and Energy.

Natural gas

During 1990-91, 21,109 million cubic metres of natural gas was produced for domestic consumption and export representing an increase of 5.0 per cent from the 1989-90 production level. A further 4,300 million cubic metres of natural gas from the export phase of the North

West Shelf project was liquefied for shipment to Japan. This export earned \$825 million and represented 20 per cent of total Australian natural gas production.

North West Shelf

The project loaded its 100th shipment of liquefied natural gas to Japan in June 1991.

Currently five ships constantly ply the Australia–Japan Liquid Natural Gas (LNG) trade route and are running at an average of six cargoes a month. With five ships available the North West Shelf project with its two existing liquefaction trains will be producing more than four million tonnes per year. Currently, LNG production on the Burrup Peninsula is averaging more than 10,000 tonnes a day.

Gas production is currently based on output from the North Rankin A platform. However, the Goodwyn A production platform was half completed by June 1991. The construction of the third LNG production train at Karratha and other Goodwyn related onshore facilities was more than half completed at the end of June 1991.

It is estimated that exports of liquefied natural gas to Japan will continue to expand, rising to about six million tonnes per year by 1993–94 with the gas being sold to eight Japanese electricity and gas utilities. It is expected these LNG sales will generate annual export revenue of \$1,058 million in 1990–91 dollars.

Oil shale

A description of the nature and location of Australian oil shale deposits was given in *Year Book Australia 1983*.

Major investigations into oil shale development have concentrated on the Condor, Rundle and Stuart deposits in Queensland.

Uranium

Australia has about 31 per cent of the Western world's low-cost uranium reserves. Deposits occur in the Northern Territory, Western Australia, South Australia and Queensland.

Australia's reasonably assured uranium resources, at December 1990, totalled 469,000 tonnes of uranium recoverable at less than \$US80 per kg U. The Australian Government's uranium policy provides that the mining and export of uranium will continue from only the Ranger and Nabarlek mines in the Northern Territory and the Olympic Dam mine in South Australia.

Commercial production at the Ranger mine commenced in 1981. Production capacity of

the mill is 3,800 tonnes U_3O_8 per annum and production for 1990 totalled 2,895 tonnes U_3O_8 . The Nabarlek deposit was mined in 1979 and the ore was stockpiled for later treatment. Production ceased in 1988 and operations ceased in 1990 when the remaining stockpiled ore was exported.

The Olympic Dam mine commenced commercial production of uranium in August 1988. Production capacity of the mill is 1,900 tonnes U_3O_8 per annum and production for 1990 totalled 1,266 tonnes U_3O_8 . The mine also produces copper, gold and silver.

All exports of Australian uranium are subject to the most stringent safeguards which provide assurance that none of the material is diverted from peaceful uses. Uranium produced in Australia is exported in the form of yellowcake for use in nuclear reactors for the generation of electricity and research and development pursuant to that purpose.

Production of uranium for 1990 was 4,160 tonnes U_3O_8 and exports were 7,441 tonnes U_3O_8 valued at around \$386 million. The large increase in export volumes in 1990 was due to the sale of the Nabarlek stockpile. The *Nuclear Non-Proliferation (Safeguards) Act 1987* gives domestic effect to Australia's international nuclear non-proliferation obligations which require domestic legislation. The legislation establishes a system of permits for the possession and transport of nuclear material (defined to cover uranium, thorium and plutonium), and other physical items such as equipment and material used in nuclear reactors. The permit and related provisions also deal with the possession and communication of sensitive information about nuclear technology, in circumstances where that information is not already a matter of public record. The legislation is administered by the Australian Safeguards Office.

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 of thorium occur in monazite.

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 presently supplies about 65 per cent of the world's traded monazite. Exports from Australia of thorium and thorium-containing ores require the approval of the Minister for Primary Industries and Energy under the Customs (Prohibited Exports) Regulations.

Solar energy

For specific applications such as domestic water and space heating, solar energy is already beginning to play a valuable role in Australia. Some six per cent of Australian residences have a domestic solar water heater with the local industry currently producing around 30,000 units annually. The use of passive solar design principles in housing is also increasing as low-cost passive designs are developed. The best prospects for using many solar energy technologies are in areas of Australia remote from the major electricity grids, where electricity costs can be anywhere from 3 to 20 times those in metropolitan areas.

Wind energy

While the bulk of Australia's inland has relatively low wind speeds, some coastal and island localities have good 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 turbine generators for remote areas. It is unlikely that, in the short to medium term, wind energy will be able to compete on a widespread and large-scale basis with coal for electricity generation in Australia. However, wind turbines could find increasing application in remote areas where wind resources are favourable and which currently rely on diesel fuel for electricity production.

Geothermal energy

The most intensive and well-documented study in Australia of sub-surface temperatures has been made using bore holes in the Great Artesian Basin. However, of the total number of indexed bores, only a very small proportion have water temperatures exceeding 100°C.

In general, it appears that cost constraints will largely restrict the use of our geothermal

resources to the supply of hot water for space heating and light industrial purposes. However, for remote homesteads and communities in areas of the Great Artesian Basin, hot artesian bores may well be used to provide an economically viable alternative source of electricity to that obtained from diesel generators.

Biomass

Only two forms of biomass are used significantly as energy in Australia. These are firewood and bagasse, both converted to energy by direct combustion.

Approximately 6.2 megatonnes of firewood are currently used annually in Australia, equivalent in energy terms to about 97 petajoules, or 2.5 per cent of Australia's total energy consumption.

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 about 79 petajoules, or 2.0 per cent of Australia's total energy consumption.

FINANCIAL AND ADMINISTRATIVE ARRANGEMENTS

Crude oil marketing and pricing arrangements

The crude oil market was deregulated on 1 January 1988. The new arrangements allow refiners and producers to negotiate freely the quantities and prices of crude oil they buy and sell. Crude oil producers also have complete freedom to export crude oil as an alternative to selling on the domestic market, subject to government policy in times of emergency. The Government no longer fixes an Import Parity Price nor requires refiners to absorb quantities of Australian oil at that price, as it did previously under the allocation system.

Decisions on major refinery investment associated with changes in domestic crude availability have been easier in a deregulated market and a significant program of investment in upgraded plant and equipment has already been undertaken.

The price of crude oil used for the purposes of excise tax assessment for Bass Strait in a free market is the monthly volume weighted

average of realised prices of sales of oil from Bass Strait.

Pricing of liquefied petroleum gas (LPG)

As from 1 February 1989, the Government no longer sets the price of LPG on the Australian market. This decision represents an important move towards a free market in LPG and brings LPG into the same pricing arena as other major petroleum products. The Prices Surveillance Authority (PSA) now has responsibility for determining the maximum wholesale price of LPG in each capital city.

Secondary tax arrangements in the petroleum industry

In addition to general taxation arrangements applying to companies in Australia, petroleum production projects are subject to secondary taxes. The type and rate of secondary taxation (resource rent tax, resource rent royalty, or excise and royalties) depends on the location of the petroleum resource, the date of discovery of the petroleum reservoir and the date upon which production commenced.

A *Resource Rent Tax* (RRT) applies to petroleum projects in the majority of Australia's offshore areas beyond the States' territorial seas. Excluded are the Bass Strait and North West Shelf production licence areas and associated exploration permits. Where RRT applies, it replaces excise and royalties which would otherwise have been levied.

A *Resource Rent Royalty* (RRR) may be applied to onshore petroleum projects by State Governments. Where RRR is applied the legislation provides for the Commonwealth to waive its crude oil excise whenever the relevant State Government negotiates an acceptable RRR agreement with the project producers and agrees to a satisfactory revenue sharing formula with the Commonwealth.

Excise applies to crude oil production from the Bass Strait and North West Shelf projects offshore and all onshore areas (except Barrow Island where a RRR applies). Excise also applies to certain LPG produced from offshore projects.

Crude oil excise is based on the annual level of crude oil sales from individual production areas and is levied as a percentage of the realised price received by producers.

Different excise scales are applicable to oil production depending upon the date of discovery of the production area and the date when the area was first developed. In the case of new offshore projects to which excise and royalty apply, and all onshore fields, the first 30 million barrels of crude oil production are exempt from excise. Production beyond this level is subject to the appropriate excise rate.

Oil discovered before 18 September 1975 ('old' oil) attracts a higher rate of excise than oil discovered on or after this date ('new' oil). An 'intermediate' scale also applies to oil produced from 'old' oil fields that were not developed as at 23 October 1984. However, in the case of all onshore fields that commenced production after 1 July 1987, production in excess of 30 million barrels is subject to 'new' oil excise.

A *Commonwealth Royalty* is also levied on offshore petroleum production except in the case where RRT applies. Proceeds are shared, generally on a 32:68 basis by the Commonwealth and the appropriate State or Territory. Thus, Victoria receives a share of the royalty from petroleum produced from Bass Strait, and Western Australia receives a share of the royalties from the North West Shelf. Onshore petroleum rights are vested in the State and Northern Territory Governments and the Commonwealth does not in general receive a share of this royalty.

Incentives to encourage petroleum exploration and development

Apart from the deregulation of crude oil marketing from 1 January 1988 and the concessions to the crude oil excise regime, the Government continues its policy of encouraging petroleum exploration and development in Australia.

Australian participation guidelines for foreign investment policy in respect of new oil and gas development proposals involving total investment of over \$10 million no longer apply. These projects will be allowed to proceed unless judged contrary to the national interest.

The immediate 100 per cent deductibility of exploration expenditure against company tax has been retained, as has the write-off over 10 or 20 years in equal instalments of expenditure on infrastructure such as pipelines.

The Government continues to release offshore petroleum exploration acreage regularly, usually twice a year. The latest release was made on 10 May 1991 and offered 21 areas off the coast of Western Australia, South Australia, Victoria, Tasmania and the Northern Territory.

GOVERNMENT INITIATIVES

Institutional arrangements

The Commonwealth Minister for Primary Industries and Energy has portfolio responsibility for national energy policy matters, including the commercial development of hydrocarbon fuels and minerals. The Department of Primary Industries and Energy provides support for a number of advisory bodies including the National Energy Research Development and Demonstration Council, the Australian Minerals and Energy Council, the National Energy Consultative Council, the National Oil Supplies Advisory Committee, the National Petroleum Advisory Committee, the National Fuels Emergency Consultative Committee, the Australian Coal Marketing and Technology Council, and the Consultative Committee on Safety in the Offshore Petroleum Industry.

The Department is also responsible for the implementation of action required from Australia's membership of the International Energy Agency and for the national system of accounting for control of nuclear materials under Australia's Agreement with the International Atomic Energy Agency.

Research and development

The Energy Research and Development Corporation (ERDC) was established in July 1990 as part of a program to improve the effectiveness of the government's investment in research and development by increasing the level of industry involvement. It is responsible for developing energy research programs in conjunction with the diverse non-coal energy sectors including gas, petroleum, renewable energy sources and systems, and electricity supply industries.

In the general research category, ERDC invested in 11 projects in 1991. The total cost of the projects is \$13 million, of which the ERDC contribution is \$4 million over an average of 3 years. This reflects the

Corporation's strategy of encouraging the pooling of resources and research skills to undertake larger, focused research which is supported by a number of partners.

ERDC has also placed considerable emphasis on the joint venture category where industry partners invest at least 50 per cent of the funds for the project. This pooling of resources results in more focused R&D, addressing specific industry needs for the short, medium and long term. The Corporation has identified three joint ventures for investment (further investments in this category will be made during 1991-92). The total value of these projects is \$19 million, of which ERDC is contributing \$3 million.

International Energy Agency (IEA)

The IEA (of which Australia is a member) 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 share remaining supplies in the event of a severe oil shortfall;
- develop alternative energy sources and the more efficient use of energy through cooperative research and development programs; and
- promote cooperative relations with other oil-producing and oil-consuming countries.

ELECTRICITY AND GAS SUPPLY

At 30 June 1990, the total installed public electric generating capacity in Australia was 34.4 million kilowatts.

Of total public electrical energy produced during 1989-90 hydro-electric sources provided approximately 10 per cent, and the balance was supplied by fossil fuels with approximately 80 per cent provided by coal. The development of coal-fired power stations has been facilitated by the presence of large demonstrated economic resources of coal close to the major industrial areas in New South Wales and Victoria.

About 90 per cent of electric power in Australia is produced by power stations owned and operated by State government utilities.

Natural gas consumption in 1990-91 was 638 petajoules, a decrease of 7.0 per cent on 1989-90 and contributed 17.4 per cent of Australia's energy requirements.

Natural gas exports in the form of LNG (Liquified Natural Gas), began in 1989 and for the year 1990-91 were equal to 185.0 petajoules.

ELECTRICITY AND GAS ESTABLISHMENTS: SUMMARY OF OPERATIONS, 1989-90(a)

Establishments at 30 June (no.)	Employment at 30 June			Wages and salaries (\$m)	Turnover (\$m)	Opening (\$m)	Purchases, transfers Stock in and selected		Value added (\$m)	
	Males (no.)	Females (no.)	Persons (no.)				Closing (\$m)	expenses (\$m)		
ELECTRICITY										
New South Wales	29	21,425	2,645	24,070	940.8	7,392.6	375.0	419.8	3,993.5	3,443.9
Victoria	13	17,925	1,554	19,479	528.6	3,084.1	126.9	145.0	797.6	2,304.6
Queensland	11	7,607	1,324	8,931	292.1	3,051.6	192.9	178.9	1,681.3	1,356.3
Other States and Territories(b)	16	12,898	1,712	14,610	429.6	3,198.5	232.8	230.2	1,086.1	2,109.8
Australia										
1989-90	69	59,855	7,235	67,090	2,191.2	16,726.8	927.5	973.8	7,558.5	9,214.6
1986-87	74	70,875	7,719	78,594	2,179.3	12,041.4	777.4	997.0	6,384.8	5,876.3
1984-85	83	75,153	7,458	82,611	2,000.8	10,154.4	714.5	631.2	5,214.8	4,856.3
1983-84	82	75,362	7,275	82,637	1,823.6	9,342.0	696.4	713.5	4,642.5	4,716.5
GAS										
Queensland	6	324	70	394	10.6	86.5	3.9	4.8	47.5	39.8
Other States and Territories(c)	28	8,326	1,960	10,286	275.1	2,903.4	74.6	81.0	1,523.7	1,386.0
Australia										
1989-90	34	8,650	2,030	10,680	285.7	2,989.9	78.5	85.8	1,571.2	1,425.8
1986-87	34	9,260	1,847	11,107	274.0	1,985.8	69.9	69.1	943.0	1,042.0
1984-85	34	8,788	1,729	10,517	229.4	1,655.2	71.8	70.0	828.5	825.0
1983-84	34	8,909	1,635	10,544	217.9	1,386.4	72.9	72.0	633.6	752.0

(a) Changes to business units definitions in 1989-90 have caused some discontinuities, particularly in relation to the number of establishments. (b) The number of electricity establishments operating at 30 June 1990 for these States/Territories were: South Australia — 5; Western Australia — 4; Tasmania — 1; Northern Territory — 5; and Australian Capital Territory — 1. (c) The number of gas establishments operating at 30 June 1990 for these States/Territories were: New South Wales — 21; Victoria — 2; South Australia — 2; Western Australia — 1; Tasmania — nil; Northern Territory — 1; and Australian Capital Territory — 1.

Source: *Electricity and Gas Establishments, Australia (8208.0)*.

The main features of the production and distribution of electricity and gas in each State and Territory are outlined below.

Snowy Mountains Hydro-Electric Scheme

The Commonwealth Government's major direct role in the electricity supply industry is its responsibility for the Snowy Mountains Scheme. It is a dual purpose complex which supplies water for electricity generation and irrigation. Located in south-eastern Australia, on its completion the Scheme 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 and Victoria and the Australian Capital Territory as they pass through power stations to the irrigation areas inland from the Snowy Mountains.

A special article on the Scheme appeared in *Year Book Australia 1986*.

New South Wales

The Electricity Commission of New South Wales is responsible for 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. As the principal generating authority, it is also responsible for the development of major new power sources except in the Snowy Mountains region.

At June 1990 the six major power stations of the Electricity Commission of New South Wales and their base load capacities were as follows: Bayswater (Hunter Valley) 2,640 MW; Liddell (Hunter Valley) 2,000 MW; Munmorah (Tuggerah Lakes) 1,200 MW; Vales Point (Lake Macquarie) 1,320 MW; Eraring (Lake Macquarie) 2,640 MW; and Wallerawang (near Lithgow) 960 MW. Two 660 MW units are being installed at Mount Piper Power Station which is located on the western coalfield near Lithgow. Commissioning of the Mount Piper station is planned to commence in 1993. The total nominal capacity of the Electricity Commission's system at 30 June 1990 was 11,390 MW. The maximum demand for electricity from the Commission's system during 1989-90 occurred on 28 June 1990 and was 9,619 MW. Electricity sent out over the Commission's system from these power stations in 1989-90 was 45,597 GWh.

Interconnection of the New South Wales and Victorian power systems with that of South Australia was completed in December 1989 and commercial operations began in March 1990. Studies have begun to explore interconnection of the New South Wales and Queensland power systems.

The greater part of the hydro-electric potential of New South Wales is concentrated in the Snowy Mountains area, which is controlled by the Snowy Mountains Hydro-Electricity Authority. New South Wales' share sent out over the Commission's system in 1989-90 was 2,347 GWh. Apart from this area, major hydro-electric stations are in operation at the Warragamba Dam (50 MW) and Hume Dam (50 MW). A pumped-storage hydro-electric system to produce 240 MW has been installed as part of the Shoalhaven Scheme in

conjunction with the Water Board. In addition, there are five smaller hydro-electric installations in operation in various parts of the State.

Electricity sent out over the Commission's system from these hydro-electric stations in 1989-90 was 374 GWh.

Total electricity generated in New South Wales from all sources in 1989-90 was 51,699 GWh.

Natural gas was made available to Sydney consumers with the completion of an overland supply pipeline from the Moomba field in South Australia in 1976. With the connection of natural gas pipelines into existing reticulation systems, the use of gas manufactured from coal or petroleum has been entirely superseded in the main population centres of the State. A number of regional centres not yet connected to the natural gas distribution network still retain their own manufactured gas production and reticulation systems. These systems are operated either by local government or by commercial interests. However, together they account for less than three per cent of total sales in New South Wales.

The total amount of gas (of all types) available for issue through mains in New South Wales in 1989-90 was 97,339 terajoules.

Victoria

The State Electricity Commission (SEC) is a semi-government authority with the principal responsibility of generating or purchasing electricity for supply throughout Victoria.

At June 1991, it distributed electricity directly to 1,607,400 customers and indirectly to a further 288,300 through 11 metropolitan councils which buy power in bulk for retail distribution under franchises granted by the Victorian Government before the SEC's establishment.

Victoria's electricity system is based upon the State's extensive brown coal resource in the Latrobe Valley, 140 to 180 kilometres east of Melbourne in central Gippsland, one of the largest single brown coal deposits in the world — see earlier section on brown coal.

The major brown coal-fired generating plants in the system are the 2,000 MW Loy Yang 'A', the 1,600 MW Hazelwood and 1,450 MW Yallourn 'W' power stations. Other

brown coal-fired plants are Morwell (170 MW). These stations are all located in the Latrobe Valley and generate 80 per cent 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), Eildon-Rubicon-Cairn Curran (135 MW) and Dartmouth (150 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 1991 was 7,763 MW, including both capacity within the State and that available to it from New South Wales. In 1990-91, electricity generated by the SEC in its thermal and hydro-electric power stations, or purchased, totalled 39,178 GWh.

The Loy Yang 'B' station, the second part of the Loy Yang project, has at this stage approved capacity of 1,000 MW in two units of 500 MW each. The first of these units is expected to be in full operation by mid-1993.

The Gas and Fuel Corporation combines the resources of government with those of private enterprise to supply gas.

Natural gas is distributed to almost 1.2 million domestic, industrial and commercial customers through an underground network of transmission pipelines and mains, some 23,380 kilometres in length.

In addition to the greater Melbourne area, a reticulated supply is provided in 53 cities and towns throughout Victoria and in Albury, New South Wales.

Ninety nine per cent of reticulated supply is Bass Strait natural gas, purchased from Esso and BHP. Six towns in western Victoria receive a reticulated supply of tempered liquefied petroleum gas.

Apart from its main business of supplying natural gas, the Corporation markets liquefied petroleum gas (LPG). Under the 'Heatane Gas' brand, LPG is sold through 118 outlets to 170,000 customers either direct or through a state-wide network of 800 independent dealers.

The Corporation consists of the parent organisation and three wholly-owned subsidiary companies: Gas and Fuel Exploration NL (with joint venture interests), CD Resources Pty Ltd, and The Albury Gas Company.

Queensland

The main supply of electricity in Queensland is controlled by the Queensland Electricity Commission (QEC). The QEC provides electricity to major users of power and to seven Electricity Boards which in 1989-90 provided power to 996,542 domestic and 165,650 commercial and industrial consumers, increases of 4.4 and 2.0 per cent respectively over the previous year.

Electricity generation in Queensland is based primarily on the State's plentiful resources of black coal. Supply of 97.1 per cent of the energy needs of the industry in 1989-90 came from this source. The Barron Gorge and Kareeya hydro-stations produced 2.9 per cent with a small amount being produced by the gas turbine stations connected to the main transmission network and by internal combustion stations supplying townships.

Annual total energy sales have been growing at 6.2 per cent per annum over the last 5 years. The annual increase in domestic sales for 1989-90 was 7.1 per cent. This was well above the average increase of the last 5 years of 4.7 per cent and for the first time in recent years above the annual increase in commercial and industrial sales at 6.1 per cent. The commercial and industrial sector however remains the dominant influence on sales accounting for two-thirds of total sales and having an average growth over the past five years of 6.3 per cent.

Planning for the future is still based on coal-fired power stations providing the bulk of Queensland's electrical energy needs, augmented as necessary by pumped-storage and conventional hydro-electric stations for peaking capacity. To meet the growth in demand, the Stanwell Power Station will be required to come on-line in 1993 and be completed in 1996. The need for the Tully-Millstream Hydro-Electric Scheme anticipated to commence generating in 1997 is under review.

Queensland has a reticulated town gas system in the Brisbane region and in the cities and towns of Bundaberg, Cairns, Roma, Dalby, Oakey and Toowoomba. By June 1990 there

were over 3,179 kilometres of mains laid in these centres and the systems serviced 116,907 consumers. Roma, Dalby, Oakey, Toowoomba, South Brisbane and the main industrial areas of North Brisbane reticulate natural gas, whereas Bundaberg, Cairns and the domestic-commercial areas of North Brisbane reticulate reformed town gas. Total sales of natural gas (excluding feedstock) in 1989-90 were 19,573 terajoules compared with 18,459 terajoules in 1988-89. Sales of reformed town gas were 1,114 terajoules and 1,134 terajoules respectively.

Western Australia

The State Energy Commission of Western Australia (SECWA) is responsible for providing economical and reliable supplies of electricity and gas.

SECWA owns and operates three major thermal power stations. These are located at Muja (1,040 MW capacity) and Bunbury (120 MW), both using local coal to produce electricity, and at Kwinana (880 MW). Kwinana power station has the capacity to burn coal, oil or natural gas, although natural gas from the North West Shelf is the major fuel used. Gas turbines are located at Pinjar (north of Wanneroo), Mungurra (south-east of Geraldton), Kwinana, Geraldton and Kalgoorlie to provide peak and emergency power.

SECWA operates two power grid systems which supply the electricity needs of 98 per cent of the State's population. The two systems are:

- *The South-West interconnected system.* Power from the three major stations provide the bulk of electricity fed into the South-West system. This grid services the metropolitan area and covers the southern portion of the State extending from Kalbarri south to Bremer Bay and from Perth east to Kalgoorlie. Kalgoorlie is fed by a 680 kilometre transmission line from Muja, one of the longest radial feed lines constructed in Australia.
- *The Pilbara interconnected system.* This system interconnects Karratha, Dampier, Cape Lambert, Wickham, Roebourne, Port Hedland and Goldsworthy. Electricity is supplied from a generating plant at Cliffs Robe River Iron Associate's power station at Cape Lambert. The plant is fuelled by North West Shelf natural gas. Back-up power can be drawn from the SECWA's stand-by diesel generating

facility at Port Hedland, from Hamersley Iron Pty Ltd's power station at Dampier and from a SECWA gas turbine generating unit also located in Dampier.

In areas too remote to utilise the interconnected grid systems, the SECWA operates 28 diesel power stations and provides support services for the Aboriginal and Torres Strait Islander Commission to help run 34 Aboriginal village power stations.

At June 1990, the SECWA's generating capacity from its interconnected grid system was 2,280 MW, while the capacity of its supply system in country areas was 184 MW. There were 623,000 customer accounts for electricity throughout the State.

The SECWA is the main supplier of gas in Western Australia. In addition to reticulating (principally) North West Shelf natural gas to customers linked to the Dampier to Bunbury pipeline, SECWA also reticulates tempered liquefied petroleum (TLP) gas to customers in Albany on the south coast and Simulated Natural Gas (SNG) to customers in Mandurah, south of Perth.

At June 1990 there were 243,731 customer accounts for natural gas and 2,537 customer accounts for TLP gas.

Development of the use of wind power to generate electricity has intensified in recent years. Wind generators augment the power supplies of Rottneest Island and Salmon Beach, close to Esperance. SECWA is currently studying the use of wind energy generators on the interconnected grid and has identified sites near Geraldton and Albany as being suitable for a wind farm of up to 20 MW capacity.

South Australia

The Electricity Trust of South Australia (ETSA) is responsible for unification and coordination of the major portion of the State's electricity supply.

At June 1990, the Electricity Trust's installed capacity was 2,350 MW. Its major power stations are Torrens Island (1,280 MW), Port Augusta Northern Power Station (500 MW), and Port Augusta Playford 'B' (240 MW). The Trust also operates gas turbine stations at Dry Creek (156 MW), Mintaro (90 MW) and Snuggery (75 MW) and a small diesel station at Port Lincoln (9 MW).

The Electricity Trust supplies directly or indirectly more than 99 per cent of all electricity customers connected to the public supply within the State. The remainder are supplied by small diesel generating plants situated in towns in the more remote areas of the State. Total Electricity Trust customers at 30 June 1991 was 670,000.

A 500 MW capacity interconnection with the Victorian–New South Wales systems has been operational since March 1990.

SAGASCO Holdings Ltd has responsibility for oil and gas exploration, development and production, and the distribution within the State of gas and LPG. It has three subsidiaries: South Australian Gas Company Ltd (to supply gas to Adelaide and surrounding areas), SAGASCO Resources Ltd (to undertake oil and gas exploration, development and production) and SAGASCO LPG Pty Ltd.

Natural gas is reticulated throughout most of Adelaide, Angaston, Whyalla, Mount Gambier, Peterborough and Port Pirie. Liquefied petroleum gas is distributed by reticulation at Roxby Downs and is available elsewhere as bottled gas.

Tasmania

Tasmania's electricity requirements are provided by the Hydro-Electric Commission. The total installed generator capacity at 30 June 1991 was 2,315 MW of which almost 90 per cent was supplied by an integrated hydro-network. An oil-fired thermal station of 240 MW is located at Bell Bay.

The Hydro-Electric Commission also purchased electricity amounting to nine GWh from two privately owned developments.

Hydro-electric power accounts for almost all reticulated energy in Tasmania. A usually reliable distribution of rainfall throughout the year and the establishment of numerous lakes within the State, has created substantial artificial storage.

The total energy generated during the 1990–91 financial year was 9,026 GWh, a 0.1 per cent increase on the previous year. Total sales amounted to 8,404 GWh of which 5,396 GWh was sold to the major industrial sector.

Total water storages at June 1991 were 24.3 per cent, the same as at June 1990. Below average rainfall for the year accounted for this position. The total energy yield from storages

during 1990–91 was 85.6 per cent of the long-term average. In order to maintain water storage levels, Bell Bay thermal station was used to contribute 992 GWh to the State's energy requirements.

Construction is continuing on two more hydro-power schemes in western Tasmania. The King River Power Development, scheduled for completion in 1992, and the Anthony Power Development, expected to be completed in 1994, will add 226 MW to the installed capacity of the system.

A 1.5 MW Wave Power Station on King Island is possible. A feasibility study is to be undertaken by a Norwegian company Norwave which has built a similar plant on Norway's west coast.

Gas is only a minor energy source in Tasmania. Town gas is manufactured and reticulated in Launceston only. Bottled LPG is a minor domestic, commercial and motor fuel in the State.

Northern Territory

The Power and Water Authority (PAWA) is responsible for generation, transmission and distribution of electricity, the provision of water and sewerage services and the sale of natural gas in the Northern Territory.

A natural gas pipeline from the Amadeus Basin in Central Australia supplies the Territory's four major centres — Darwin, Katherine, Tennant Creek and Alice Springs — all of which use indigenous natural gas, replacing imported heavy fuel oil and distillate as fuel for electricity generation. A combined cycle block of 100 MW comprises half of the installed capacity at Channel Island Power Station near Darwin.

A privately built, owned and operated transmission line between Darwin and Katherine, allows reserve capacity to be shared and has reduced costs because of the higher operating efficiencies of Channel Island Power Station compared with Katherine Power Station.

PAWA supplies electricity to some 44,500 customers in four major centres, seven minor centres and 75 small remote communities.

Australian Capital Territory

Electricity is distributed within the Territory by the ACT Electricity and Water Authority

(ACTEW). During 1990–91 the total bulk electricity purchased was 2,239 GWh, comprised of 1,569 GWh provided by the Electricity Commission of New South Wales and a reservation of 670 GWh from the Snowy Mountains Hydro-Electric Authority. The system maximum demand was 524 MW. The authority supplied 110,699 customers at June 1991.

Natural gas from the Moomba fields in South Australia is piped to Canberra via a 70 kilometre spur which branches from the main Moomba–Sydney pipeline at Dalton.

During 1990–91, AGL Canberra Ltd reticulated 3,396 terajoules of natural gas to 1,052 commercial and industrial establishments and about 30,000 homes.

BIBLIOGRAPHY

ABS Publications

Directory of Energy Related Statistics, 1992 (1107.0)

Domestic Firewood and Coal Usage, Tasmania, 1985 (8204.6)

Electricity and Gas Establishments, Australia (8208.0)

National Energy Survey: Annual Consumption of Reticulated Energy by Households, Australia, 1985–86 (8213.0)

National Energy Survey: Energy Consumption in Industry, Australia, 1986–87 (8217.0)

National Energy Survey: Household Appliances, Facilities and Insulation, Australia, 1985–86 (8212.0)

National Energy Survey Household Sample File on Magnetic Tape, 1985–86 (8220.0)

National Energy Survey: Household Sample File on Magnetic Tape, 1985–86 (8215.0)

National Energy Survey: Weekly Reticulated Energy and Appliance Usage Patterns by Season, Households, Australia, 1985–86 (8218.0)

New South Wales Energy Survey, October 1984: Part 2 — Household Energy Consumption (8212.1)

New South Wales Energy Survey, October 1984: Sample File on Magnetic Tape (8215.1)

New South Wales Energy Survey: Part 1 — Household Appliances, Facilities, Insulation and Appliance Acquisition, October 1984 (8211.1)

Other Publications

Other organisations which produce statistics in this field include the Department of Primary Industries and Energy, the Joint Coal Board, the Australian Institute of Petroleum and the Electricity Supply Association of Australia. 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.

FOR MORE INFORMATION

The ABS has a far wider range of information on Australia than that contained in the *Year Book*. Information is available in the form of regular publications, electronic data services, special tables and from investigations of published and unpublished data.

For further information contact ABS Information Services at one of the addresses listed on the page facing the Introduction to the *Year Book*.
