

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. 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	51.4 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 — gegalitres.

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 in situ resources of black coal, currently estimated at 77.8 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 1991–92 was 176.1 Mt.

For further details relating to the production of black coal in Australia see the chapter, Mining and Minerals. 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, Mining and Minerals, 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 Australian Geological Survey Organisation (formerly the Bureau of Mineral Resources, Geology and Geophysics) indicate that there is an average probability of finding at least another 380 ggalitres (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.

19.1 PETROLEUM RESOURCES(a), DECEMBER 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.)	123	22	44	161
Carnarvon (WA)	28	58	50	256
Cooper/Eromanga (SA/Qld)	12	7	11	78
Amadeus (NT) and Bonaparte (WA/NT)	30	—	1	12
Perth (WA)	1	—	—	3
Bowen/Surat (Qld)	—	—	—	6
Canning (WA)	—	—	—	—
Otway (Vic.)	—	—	—	1
Total	194	87	106	517
Demonstrated sub-economic resources(c)				
Gippsland/Bass (Vic./Tas.)	54	3	—	104
Bonaparte (WA/NT)	8	8	12	166
Carnarvon (WA)	60	34	25	717
Cooper/Eromanga (SA/Qld)	—	2	5	41
Browse (WA)	—	32	55	451
Perth (WA)	—	—	—	—
Amadeus (NT)	—	—	—	7
Bowen/Surat/Adavale (Qld)	—	—	—	2
Bass (Tas./Vic.)	2	6	8	10
Otway (SA/Vic.)	—	—	—	—
Total	124	85	105	1,498

(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 1991–92 at 31,309 megalitres (ML) (538 thousand barrels per day) of crude oil and condensate was slightly lower than production in 1990–91 of 31,955 ML. In 1991–92, the Bonaparte Basin produced 3,796 ML of crude oil, nearly 12 per cent of the total indigenous oil production. Production of crude oil from the Gippsland Basin accounts for 54 per cent of total indigenous crude oil production. The North West Shelf was the major producer of condensate during 1991–92 with 56 per cent of indigenous production sourced in that region.

Export volumes of crude oil and condensate increased by 1.7 per cent in 1991–92 compared with 1990–91, to 8,972 ML. The main markets were Japan, Indonesia and Singapore. Imports of crude oil and condensate increased by 15 per cent to 15,332 ML.

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 ML were concentrated in Bass Strait, the North West Shelf and the Cooper Basin.

Production of naturally occurring LPG in Australia in 1991–92 was 3,589 ML. The major contributors to this total were the Bass Strait fields (2,558 ML or 71% of total production) and the Cooper Basin (930 ML or 26% of total production). About 43 per cent of domestic LPG production is exported (1,568 ML in 1991–92), mainly to Japan. Domestic consumption of 3,318 ML in 1991–92 was met by 1,369 ML of product derived from processing industries, with supply shortfalls being met by naturally occurring product and imports.

19.2 PETROLEUM PRODUCTION

Year	Crude oil and condensate	LPG(a)	Natural gas
	ML	ML	GL
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	20,090
1990–91	31,955	3,547	21,109
1991–92	31,309	3,589	22,542

(a) Naturally occurring.

Source: Department of Primary Industries and Energy.

Natural gas

During 1991–92, 22,542 million cubic metres of natural gas was produced for domestic consumption and export representing an increase of 6.8 per cent from the 1990–91 production level. A further 6,070 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 \$843 million and represented 20 per cent of total Australian natural gas production.

North West Shelf. The initial phase of the North West Shelf Gas Project is due for completion in 1992–93, with the completion of three processing modules and a fleet of seven dedicated LNG carriers in service. In 1992, LNG production on the Burrup Peninsula averaged more than 14,000 tonnes a day.

It is estimated that exports of liquefied natural gas to Japan will continue to expand, rising to a peak of seven million tonnes per year by 1994–95. It is expected that these LNG

sales to Japan will generate annual export revenue of \$1.4 billion in 1991-92 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.

Production capacity of the mill at the Ranger mine is 3,800 tonnes U_3O_8 per annum and production for 1991-92 totalled 2,979 tonnes U_3O_8 . Nabarlek operations ceased in 1990.

Production capacity of the mill at the Olympic Dam mine is 1,900 tonnes U_3O_8 per annum and production for 1991-92 totalled 1,369 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 1991-92 was 4,348 tonnes U_3O_8 and exports were 4,730 tonnes U_3O_8 valued at around \$245 million. 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 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 100 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 85 petajoules, or 2.2 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. Refiners and producers are allowed 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 prior to deregulation.

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) 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 25 May 1992 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 10 projects in 1991-92. The total cost of the projects is \$13 million, of which the ERDC contribution is \$4 million over an average of three 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 invested in six joint ventures during 1991-92. The total value of these projects is \$29 million, of which ERDC is contributing \$4.5 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 1991, the total installed public electric generating capacity in Australia was 33.9 million kilowatts.

Of total public electrical energy produced during 1990-91 hydro-electric sources provided approximately 11 per cent, and the balance was supplied by fossil fuels with approximately 81 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 1991-92 was 676 petajoules, an increase of 3.0 per cent on 1990-91 and contributed 17.4 per cent of Australia's energy requirements.

Natural gas exports in the form of LNG (Liquefied Natural Gas), began in 1989 and for the year 1991-92 were equal to 235 petajoules.

19.3 ELECTRICITY AND GAS ESTABLISHMENTS: SUMMARY OF OPERATIONS, 1990-91(a)

	Establishments at 30 June (no.)	Employment at 30 June			Wages and salaries Turnover		Purchases, transfers, Stock in and selected expenses			Value added (\$m)
		Males (no.)	Females (no.)	Persons (no.)	(\$m)	(\$m)	Opening (\$m)	Closing (\$m)	(\$m)	
ELECTRICITY										
New South Wales	29	20,380	2,692	23,072	896.2	7,329.9	437.4	452.6	4,297.3	3,047.8
Victoria	12	15,930	1,295	17,225	654.0	3,291.1	143.7	118.6	958.4	2,307.6
Queensland	11	7,560	1,223	8,783	289.1	3,088.3	156.9	137.4	1,692.7	1,376.1
Other States and Territories(b)	14	12,539	1,487	14,026	467.1	3,238.0	234.2	218.2	1,172.8	2,049.2
Australia										
1990-91	66	56,409	6,697	63,106	2,306.5	16,947.3	972.2	926.7	8,121.1	8,780.7
1989-90	68	59,824	7,231	67,055	2,219.0	15,988.0	936.0	981.6	7,512.1	8,521.5
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										
Australia										
1990-91(c)	30	8,481	2,014	10,495	311.9	2,788.4	74.6	81.4	1,526.3	1,268.9
1989-90	34	8,780	2,108	10,888	287.6	2,687.0	78.5	85.8	1,373.0	1,321.3
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 1991 for these States/Territories were: South Australia — 6; Western Australia — 3; Tasmania — 1; Northern Territory — 3; and Australian Capital Territory — 1. (c) The number of gas establishments operating at 30 June 1991 for the States/Territories were: New South Wales — 19; Victoria — 1; Queensland — 5; 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

Pacific Power (formerly the Electricity Commission) is responsible for the production of electricity and its bulk transmission throughout New South Wales. 25 electricity supply authorities handle the retail distribution of electricity to consumers. It also supplies several large industrial customers.

Electricity for New South Wales is generated mainly in coal-fired thermal power stations, supplemented by a share of the Snowy Mountains Scheme together with smaller hydro and gas turbine power stations.

At June 1991 the six major power stations of Pacific Power and their base load capacities were as follows: Bayswater (Hunter Valley) 2,640 MW; Liddell (Hunter Valley) 2,000 MW; Munmorah (Tuggerah Lakes) 600 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 Pacific Power's system at 30 June 1991 was 10,790 MW. The maximum demand for electricity from the system during 1990-91 occurred on 31 July 1990 and was 9,374 MW. Electricity sent out from these power stations in 1990-91 was 45,849 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 its system in 1990-91 was 2,971 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 Pacific Power's system from these hydro-electric stations in 1990-91 was 335 GWh.

Total electricity generated in New South Wales from all sources in 1990-91 was 48,885 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 superseded in the main population centres of the State. By 1991, all Sydney homes with reticulated gas supply had been converted to direct use of natural gas. At June 1991, Sydney users of natural gas totalled about 420,000 residential accounts and 17,000 other users (mainly commercial/industrial).

The total amount of gas (of all types) available for issue through mains in New South Wales in 1990-91 was 94 petajoules.

Victoria

The State Electricity Commission (SEC) is a body corporate and one of the largest public sector organisations in Australia. It is a self-supporting business and is the principal supplier of electricity throughout Victoria.

At June 1992, it distributed electricity directly to 1,631,100 customers and indirectly to a further 289,200 through 11 metropolitan councils.

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, followed by Morwell (170 MW). These stations are all located in the Latrobe Valley and generate 85 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 1992 was 7,763 MW, including both capacity within the State and that available to it from New South Wales. In 1991-92, electricity generated by the SEC in its thermal and hydro-electric power stations, or purchased, totalled 39,109 GWh.

The Loy Yang 'B' station, the second part of the Loy Yang project, has 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.

Gas is reticulated to around 1.24 million domestic, industrial and commercial customers through an underground network of transmission pipelines and mains, some 23,400 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 to around 170,000 customers either direct through 113 autogas outlets 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 1990-91 provided power to 1,031,612 domestic and 169,271 commercial and industrial consumers,

increases of 3.5 and 2.2 per cent respectively over the previous year.

Electricity generation in Queensland is based primarily on the State's plentiful resources of black coal. 97 per cent of the energy generated in 1990-91 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 an average 5.8 per cent per annum over the five years from 1986 to 1991. The commercial and industrial sector remains the dominant influence on sales and accounts for two-thirds of total sales. Domestic consumers account for most remaining sales. Commercial and industrial sales rose 4.1 per cent from 1990 to 1991, down from an average 5.7 per cent annual increase over the five years 1986 to 1991. Domestic sales increased 3.5 per cent from 1990 to 1991; also below the sector's average annual growth of 4.7 per cent over the five years to 1991. The growth of total sales was above that of each of the major components because of high growth in sales to the rail sector.

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. An independent taskforce was established by the Queensland Government to conduct an inquiry in to the State's future electricity needs and the requirements for the Tully-Millstream Hydro-Electric Station. The Queensland Government forwarded the taskforce's report to the Commonwealth Government and to the Wet Tropics Management Authority, and has formed a joint panel with them to consider the scheme.

Natural gas produced for sale in Queensland comes from two main areas, the Surat-Bowen Basin concentrated around Roma, and the Denison Trough. Natural gas from the Surat-Bowen Basin is piped to the Wallumbilla junction of the Roma to Brisbane pipeline for compression and reticulation to domestic, commercial and industrial consumers in Roma, Dalby, Oakey, Toowoomba, Ipswich, Brisbane and the Gold Coast.

Of the natural gas used in Queensland in 1990–91, 31,929 terajoules (88.3%) was sold to consumers, 1,447 terajoules (4.0%) was used as feedstock for reformed town gas production for the north Brisbane franchise area, 2,173 terajoules (6.0%) was used as field and plant fuel and the residual 631 terajoules (1.7%) represented pipeline compressor fuel and unaccounted for losses.

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 1992, 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 1992 was 680,644.

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 Renmark and is available elsewhere as bottled gas.

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) (360 MW), Mungurra (south-east of Geraldton) (108 MW), Kwinana (20 MW), Geraldton (20 MW) and Kalgoorlie (55 MW) 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 48 Aboriginal village power stations.

At June 1992, the SECWA's generating capacity from its interconnected grid system was 2,638 MW, while the capacity of its supply system in country areas was 181 MW. There were 656,927 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 1992 there were 280,960 customer accounts for natural gas, 2,705 customer accounts for TLP gas and 1,341 customer accounts for SNG.

Development of the use of wind power to generate electricity has intensified in recent years. Wind generators augment the power supplies of Esperance and Rottnest Island. SECWA is building a new two MW wind farm a short distance from the Esperance facility. Other wind generation sites outside the interconnected grid are being studied.

Tasmania

Tasmania's electricity requirements are provided by the Hydro-Electric Commission. The total installed generator capacity at 30 June 1992 was 2,458 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 seven 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 1991-92 financial year was 8,923 GWh, a small decrease from the previous year. Total sales amounted to 8,267 GWh of which 5,270 GWh was sold to the major industrial sector.

Total water storages at June 1992 were 32.3 per cent, a rise of 8.0 per cent in the 12

month period. The total energy yield from storages during 1991-92 was 103.4 per cent of the long-term average. Bell Bay thermal station was used to contribute five GWh to the State's energy requirements.

Construction of the King River Power Development on Tasmania's west coast was completed during 1991-92 and the John Butters Power Station, with an installed capacity of 143 MW began generating electricity during February 1992. Construction work on the Anthony Power Development continues with completion due in early 1994, and 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 1991–92 the total bulk electricity purchased was 2,292 GWh, comprised of 1,622 GWh provided by Pacific Power (formerly 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

562 MW. The authority supplied 113,690 customers at June 1992.

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 1991–92, AGL Canberra Ltd reticulated 3,785 terajoules of natural gas to 1,165 commercial and industrial establishments and about 34,500 homes.

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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*.