
ENERGY

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 an important 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.

As well as ensuring energy policies are consistent with major economic, industry and social policy objectives, the key objective of the Commonwealth's energy policy is the promotion of an efficient, competitive and dynamic energy sector in the context of appropriate environmental considerations and a reasonable return to the community for the use of these resources.

In 1988 Australia completed an energy policy review, examining its current energy situation and what the future holds for it. The review began with a series of discussion papers and a conference, culminating with the publication of '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. This does not mean setting rigid self-sufficiency targets and planning their achievement, but simply ensuring the availability of a diverse range of energy supplies on a commercial basis and at acceptable prices to meet our varied and changing needs;
- to achieve the most efficient and competitive domestic energy supply industry in order to minimise domestic costs and so sustain internationally competitive industrial sectors, and to contribute to rising standards; 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 reserves, it can continue current production rates in these energy sources for 360 years (black coal only), 55 years, and 120 years respectively. In fact Australia is one of only five Organisation for Economic Co-operation and Development (OECD) countries that are net energy exporters. Australia is:

- the world's largest exporter of coal, accounting for around 25 per cent of the world 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;
- currently an exporter of Liquid 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 in 1988 were:

Black Coal	50 gigatonnes
Brown Coal	42 gigatonnes
Natural Gas	1,069 TL
Uranium	480 kilotonnes U
Crude Oil, Gas Condensate and LPG	462 giganlitres

NOTE: As at 30 June 1988.

There is one area however, where Australia will rely more on the international market as an importer—crude oil. There is likely to be an increasing disparity between domestic oil supplies and use. This will largely be the result of a marked decline in the production of crude oil from Bass Strait, Australia's main existing production area.

In line with trends in recent years, conservation and greater efficiency in oil use, and the switch to alternative energy sources prompted by the instability and uncertainty surrounding international oil supplies should see oil's share in Australia's total energy demand falling slightly from 39 per cent to 36 per cent in the year 2000.

Advice and Coordination

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 advice to the Minister on energy policy and provides support for a number of advisory bodies including the National Energy Research Development and Demonstration Council (NERDDC), the Australian Minerals and Energy Council (AMEC), the National Energy Consultative Council (NECC), the National Oil Supplies Advisory Committee (NOSAC), the National Petroleum Advisory Committee (NPAC), the National Fuels Emergency Consultative Committee (NFECC), the Australian Coal Marketing and Technology Council (ACMTC), and the Consultative Committee on Safety in the Offshore Petroleum Industry (COSOP).

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

International Energy Agency—IEA

The IEA was established in Paris in November 1974 as an autonomous institution within the framework of the OECD. Australia joined the IEA in May 1979.

The Agency carries out the International Energy Program and the Long Term Co-operation Program. These programs aim to:

- prepare member countries against risk of oil supply disruptions and 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;
- promote cooperative relations with other oil-producing and oil-consuming countries.

Australian Coal Marketing and Technology Council—ACMTC

The Australian Coal Marketing and Technology Council was established in 1988 as part of the Commonwealth Government's coal industry strategy. The Council's role is to advise on measures to enhance Australia's export trade in coal. The Council serves as a major source of advice to the Minister for Primary Industries and Energy to assist in maintaining the viability of an internationally efficient Australian coal industry.

The Council's membership consists of a chairman, industry and union representatives, a commercial marketing expert, and a technical expert.

Research and Development

National Energy Research, Development and Demonstration (NERD&D) Program

The NERD&D Program was established in 1978 to stimulate the level of energy research, development and demonstration in Australia in line with government energy policy and priorities. Grants under the Program have been approved by the Minister for Resources on the advice of the National Energy Research, Development and Demonstration Council (NERDDC).

To December 1989, \$248 million has been committed under the NERD&D Program to about 1,600 research projects undertaken by government, industry and universities.

In line with its announced policy of replacing existing advisory councils with research and development corporations, passage of broadly directed enabling legislation will allow the Government to replace NERDDC with a National Energy R&D Corporation and Coal Industry R&D Corporation. The Corporations are expected to be established during 1990.

Additional Commonwealth support for energy research and development is provided through budget appropriations to Commonwealth agencies such as CSIRO, BMR, and ANSTO, and through Commonwealth funding of all Australian universities. The Commonwealth also provides an incentive for research and development through the 150 per cent tax concession scheme and through the Grants for Industry Research and Development (GIRD) scheme.

Commonwealth Scientific and Industrial Research Organisation—CSIRO

Energy research within the Institute of Minerals, Energy and Construction is carried out with the objectives of increasing the international competitiveness, export earnings, gross domestic product and value of services provided by the energy industries. Divisions of the Institute engaged in energy research include Geomechanics, Fuel Technology, Coal Technology, Mineral Products, Mineral and Process Engineering and Building, Construction and Engineering.

Australian Minerals and Energy Council—AMEC

The Australian Minerals and Energy Council was established in April 1976 by agreement between State and Commonwealth mines and energy Ministers, replacing the former Australian Minerals Council. AMEC is principally a body for consultation on minerals and energy matters and provides a forum for Ministers to discuss policy issues of mutual concern and coordinate policy action. An AMEC advisory committee which is composed of the departmental heads or their nominees provides for officer level consultation and information exchange. AMEC establishes committees, sub-committees and working parties to undertake specific tasks and report back through its advisory committee as the need arises.

National Oil Supplies Advisory Committee—NOSAC

The National Oil Supplies Advisory Committee was formed in 1983 by the amalgamation of separate Commonwealth-industry and Commonwealth-State bodies set up during the

period of tight oil supply in 1979. Representatives of the Commonwealth Government, State Government energy authorities and major domestic oil producers and refiners meet about twice a year to review the situation and outlook for domestic and international oil supplies. Matters discussed include oil production, new oil and gas developments, imports, exports, stock levels, regional shortages, industrial relations, shipping, technical matters and government policies affecting the oil industry.

National Petroleum Advisory Committee—NPAC

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

National Fuels Emergency Consultative Committee—NFECC

The NFECC, chaired by the Commonwealth and comprising officials of the Commonwealth, States and the Northern Territory, was established in late 1983 to consult and advise governments on matters relevant to the preparation for, and detailed management of, a national liquid fuels crisis; and to act as the prime channel of consultation between governments in the event of such a crisis.

National Energy Consultative Council—NECC

The NECC was established in April 1988 following the recommendation of the Energy 2000 national energy policy review. The purpose of the NECC is to monitor and review the current energy situation and the energy outlook for Australia with particular reference to any major changes in trend away from the projections and positions outlined in the Energy 2000 review. Its purpose is to examine overall energy policy as well as the position of specific industry sectors. In addition it provides a forum for State and Territory governments, the energy industries and trade unions to present their views to the Commonwealth Government on the current situation and outlook in particular energy industries and expected future developments.

Consultative Committee on Safety in the Offshore Petroleum Industry—COSOP

The COSOP was formed following the accident involving the Piper Alpha platform in the North Sea on 6 July 1988. The Committee's principal role is to review the findings of inquiries by the British Government into the Piper Alpha accident and their implications for Australian offshore operations.

The Committee consists of representatives from the major Australian offshore operators, State governments with active offshore production programs, the trade union movement and the Commonwealth Government.

Energy research and development statistics

The last survey of organisations engaged in energy research and development covered the period 1986–87 and provided estimates of expenditure classified by energy objective.

The estimate of human resources devoted to energy R&D in Australia during 1986–87 was 2,822 person years. Of this amount, business organisations accounted for 1,176 person years, general government organisations for 780 person years, higher education organisations for 862 person years and private non-profit organisations for 4 person years. Summary statistics are included in *Year Book No. 72* and more detailed statistics are contained in the ABS publication *Research and Experimental Development; All Sector Summary, Australia, 1986–87* (8112.0).

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.

Australia's inferred resources of black coal are very large, amounting to over 550 gigatonnes (Gt). At 30 June 1988, Australia's economically recoverable resources of black coal were estimated to total 50 Gt. 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 1988-89 was 149 Mt.

For further details relating to the production of black coal in Australia *see* Chapter 15, Mineral Industry. Details about the nature and age of black coal are given in *Year Book* No. 64.

Brown coal

Australia's measured and indicated resources of brown coal were estimated to be around 42 Gt at 30 June 1988. 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 for power generation, briquetting and char manufacture.

Petroleum

The level of offshore petroleum exploration activity in 1988 continued to rise compared to 1986 and 1987, and the outlook for 1990 is that this trend will continue. Onshore activity however, has declined in 1989 due to the uncertainty in world oil prices and is likely to remain subdued in 1990.

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 gegalitres (GL) (2,400 million barrels) of crude oil in Australia. This compares with demonstrated economically recoverable resources of 240 GL (1,510 million barrels) and demonstrated sub-economically recoverable resources of 28 GL (176 million barrels) as at 31 December 1988.

PETROLEUM RESOURCES (a) AS AT 31 DECEMBER 1988
(Source: Department of Primary Industries and Energy)

Basin	Crude oil	Gas condensate	LPG	Sales gas
	GL	GL	GL	TL
Demonstrated economic (b)—				
Gippsland (Vic.)	181	24	48	197
Carnarvon (WA)	30	85	60	670
Cooper/Eromanga (SA/Qld)	13	7	11	74
Amadeus (NT) and Bonaparte (WA/NT)	30	6	11	84
Perth (WA)	1	—	—	5
Bowen/Surat (Qld)	—	—	—	3
Canning (WA)	—	—	—	—
Otway (Vic.)	—	—	—	(c)
Total	255	122	130	1,033
Demonstrated sub-economic (d)—				
Gippsland/Bass (Vic./Tas.)	12	10	—	35
Bonaparte (WA/NT)	4	1	4	81
Carnarvon (WA)	11	2	—	378
Cooper/Eromanga (SA/Qld)	1	3	5	35
Browse (WA)	—	32	23	489
Perth (WA)	—	—	—	—
Amadeus (NT)	—	—	—	10
Bowen/Surat/Adavale (Qld)	—	—	—	5
Bass (Tas./Vic.)	1	8	5	8
Otway (SA/Vic.)	—	—	—	6
Total (e)	28	56	37	1,048

(a) Based on the McKelvey classification which sub-divides resources in terms of the economic feasibility of extraction and their certainty of occurrence. (b) Demonstrated economic resources are resources judged to be economically extractable and for which the quantity and quality are computed from specific measurements and extrapolations on geological evidence. (c) Gas resource very small. (d) 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. (e) Discrepancies between totals and sums of components are due to rounding.

Crude oil and condensate

Indigenous production in 1988–89 at 28,255 megalitres (486 thousand barrels per day) of crude oil and condensate was 9.6 per cent less than production in 1987–88 and 11 per cent less than the peak level of production achieved in 1985–86. Production of crude oil from the Bonaparte Basin has continued to grow since production started in 1986–87. In 1988–89 the Bonaparte Basin produced 2,430 megalitres of crude oil, nearly 10 per cent of the total indigenous oil production. Production of crude oil from the Gippsland Basin decreased by 19 per cent from the 1987–88 level, but that Basin still accounts for 70 per cent of total indigenous crude oil production. The North West Shelf was the major producer of condensate during 1988–89 with 42 per cent of indigenous production sourced in that region.

Export volumes of crude oil and condensate increased by 6.9 per cent in 1988–89 compared with 1987–88 to a new record of 6,904 megalitres. The main markets were the United States, Singapore and New Zealand. Imports of crude oil and condensate also increased to over 10,000 megalitres, the highest level since 1982–83.

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 June 1988 of 97,000 megalitres (ML) are concentrated in Bass Strait, the North West Shelf and the Cooper Basin.

Production of naturally occurring LPG in Australia in 1988–89 was 3,763 ML. The major contributors to this total were the Bass Strait fields (2,689 ML or 71 per cent of total production) and the Cooper Basin (974 ML or 26 per cent of total production). About 58 per cent of domestic LPG production is exported (2,178 ML in 1988–89), mainly to Japan. Domestic consumption of 2,472 ML in 1988–89 was met by 808 ML of product obtained from refineries, with supply shortfalls being met by naturally occurring product and import.

PETROLEUM PRODUCTION IN AUSTRALIA
(Source: Department of Primary Industries and Energy)

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

(a) Naturally occurring.

Natural gas

During 1988–89, 15,772 million cubic metres of natural gas was produced for domestic consumption. This was 3.3 per cent more than in 1987–88. About 10,886 million cubic metres or 69 per cent of natural gas was sourced in the Cooper Basin. The North West Shelf contributed 3,905 million cubic metres or 25 per cent to the total.

North West Shelf Project

The North West Shelf natural gas project is the largest single resource development program ever undertaken in Australia. The project is estimated to have a total capital cost of \$12 billion, excluding LNG tankers. Of this, \$2,100 million has been spent by the JVP for the supply of natural gas to the domestic markets of south-west Western Australia and the Pilbara. It comprises the North Rankin 'A' platform, a 134 kilometre submarine pipeline, the onshore domestic gas plant and associated site engineering services. The State Energy Commission of Western Australia (SECWA) also constructed a 1,500 kilometre pipeline to service the domestic markets.

The second phase, the LNG export phase, currently estimated to cost \$9.8 billion, includes onshore LNG plant (\$3,500 million), two more offshore production platforms, further drilling and pipelines, site engineering and the provision of infrastructure and housing in Karratha. Seven 125,000 cubic metre LNG tankers (costing about \$1.6 billion) will also be required.

The first LNG export shipment to Japan left Australia in July 1989, three months ahead of schedule. The project was formally inaugurated by the Prime Minister on 19 September 1989.

LNG exports to Japan take place under a twenty year contract. LNG exports to Japan in 1989–90 will total 2.1 million tonnes, rising to nearly 6 million tonnes by 1994. It is expected that the project will generate some \$41 billion in revenue in dollars of the

day terms. North West Shelf gas is sold to five electricity and three gas utilities in Japan, which will supply a combined market of some 90 million people.

On 4 April 1989 it was announced that development of the Goodwyn 'A' field would proceed at an estimated cost of \$1.6 billion. The Goodwyn field will supplement North Rankin gas production in order to meet the North West Shelf Project's contractual commitments for the sale of natural gas to the State Energy Commission of Western Australia and LNG to the Japanese buyers.

The National Liaison Group (NLG) on the North West Shelf was established to serve as a forum for the exchange of information with a view to increasing Australian content in contracts and purchase orders for the project. It comprises representatives of the Commonwealth and State governments, trade unions and industry associations together with the JVP. The Commonwealth Minister for Resources and Energy is joint chairman with the Western Australian Minister for Minerals and Energy. The aim of the NLG is to maximise Australian content provided cost, quality and performance criteria are met. The fundamental principle is that Australian industry should have a full and fair opportunity to compete in tenders for the project.

The North West Shelf Project is one of national significance, with the potential for major impact on Australia's international trading position.

Oil shale

A description of the nature and location of Australian oil shale deposits was given in *Year Book* No. 67.

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

Uranium

Australia has about 29 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 1988, totalled 480,000 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 but only from 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 at a planned rate of 3,000 tonnes U_3O_8 per annum. Production for 1988 totalled 3,231 tonnes U_3O_8 . The Nabarlek deposit was mined in 1979 and the ore was stockpiled for later treatment. Production at a planned rate of 1,000 tonnes U_3O_8 per annum, commenced in 1980. Production for 1988 totalled 481 tonnes U_3O_8 . Processing of high grade ore was completed during 1988 and the mill is currently being held on a care and maintenance program. Exploration is continuing with a view to establishing further resources.

The Olympic Dam mine commenced commercial production of uranium in August 1988. Production for 1988 totalled 452 tonnes U_3O_8 at a rate of 1,500 tonnes U_3O_8 per year. The mine will also produce 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 for the production of radioisotopes and radio pharmaceuticals.

Production of uranium for 1988 was 4,165 tonnes U_3O_8 and exports were 4,327 tonnes valued at around \$373 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 6 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 the 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 subsurface 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 5.5 megatonnes of firewood are currently used annually in Australia, equivalent in energy terms to about 88 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 71 petajoules, or 2.0 per cent of Australia's total energy consumption.

Crude Oil Marketing and Pricing Arrangements

Crude oil marketing arrangements were deregulated from 1 January 1988, allowing refiners and producers to negotiate freely with both Australian and overseas suppliers the quantities and prices of crude oil they buy and sell. 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.

Crude oil producers now have complete freedom to export crude oil as an alternative to selling on the domestic market, subject to Government policy in times of emergency.

Decisions on major refinery investment associated with changes in Australia's crude oil self sufficiency will be easier in the deregulated market and refiners are already starting to invest in upgraded plant and equipment. For example, BP Kwinana has commissioned a residue cracking unit to process heavier imported crude. Ampol is constructing a continuous reformer at its Brisbane refinery to produce high octane blendstock for unleaded petrol at a cost of more than \$100 million and Shell plans to extend and upgrade its Geelong and Clyde refineries at a total cost of more than \$600 million.

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) policy 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 of 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 has introduced a number of other policy initiatives to encourage petroleum exploration and development in Australia.

On 20 January 1988 the Treasurer announced that Australian participation guidelines for foreign investment policy in respect of new oil and gas development proposals involving total investment of over \$10 million will no longer apply. These projects will be allowed to proceed unless judged contrary to the national interest.

On 25 May 1988 in the May Economic Statement the Treasurer announced that the company tax rate would be reduced from 49 per cent to 39 per cent from 1 July 1988. 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 general level of tariffs on imports is to be reduced to 10 per cent and 15 per cent over the next four years depending on the tariff category of the equipment. Further, the 2 per cent revenue duty on imports of post wellhead items is being abolished.

The Government continues to release offshore petroleum exploration acreage regularly, usually twice a year. The latest release was made on 2 August 1989 and offered 12 offshore areas in the Western Australian, Tasmanian and Queensland Adjacent Areas.

Pricing of liquified petroleum gas—LPG

Following a major review of LPG pricing arrangements in Australia, it was decided that the Government, as of 1 February 1989, would no longer set 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.

Reticulated Energy

Electricity and gas establishments in Australia

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

The following table shows a summary of operations of electricity and gas establishments for 1986–87. Further details are available in the publication *Electricity and Gas Establishments: Details of Operations, Australia 1986–87* (8208.0).

ELECTRICITY AND GAS ESTABLISHMENTS: SUMMARY OF OPERATIONS, 1986-87

	Establishments at 30 June (No.)	Employment at 30 June			Wages and salaries		Turnover		Stocks		Purchases, transfers in and selected	Value added (\$m)
		Males (No.)	Females (No.)	Persons (No.)	(\$m)	(\$m)	Opening (\$m)	Closing (\$m)	expenses (\$m)			
ELECTRICITY												
New South Wales	29	26,596	3,004	29,600	792.0	5,097.3	399.2	508.9	3,003.0	2,204.0		
Victoria	14	19,036	1,800	20,836	579.4	2,345.4	69.5	79.6	1,119.7	1,235.8		
Queensland	12	9,374	1,355	10,729	327.6	2,335.0	149.3	211.9	1,471.9	925.7		
Other States and Territories (a)	19	15,869	1,560	17,429	480.3	2,263.8	159.4	196.6	790.2	1,510.8		
Australia—	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	
	1982-83	85	75,209	7,299	82,328	1,689.6	8,343.3	530.6	693.2	4,313.6	4,192.3	
GAS												
New South Wales	20	2,367	532	2,899	69.8	448.3	22.7	22.9	278.4	170.1		
Queensland	8	640	136	776	17.0	132.8	8.0	6.8	68.5	63.0		
Other States and Territories (b)	6	6,253	1,179	7,432	187.2	1,404.8	39.2	39.4	596.1	808.8		
Australia—	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	
	1982-83	37	9,013	1,571	10,584	206.4	1,158.1	58.7	72.1	545.5	626.0	

(a) The number of electricity establishments operating at 30 June 1987 for these States/Territories were: South Australia-9; Western Australia-6; Tasmania-1; Northern Territory-2; and Australian Capital Territory-1. (b) The number of gas establishments operating at 30 June 1987 for these States/Territories were: Victoria-1; South Australia-2; Western Australia-1; Tasmania-1; Northern Territory-nil; and Australian Capital Territory-1.

Electricity

At June 30, 1988 the total installed public electric generating capacity in Australia was 34.8 million kilowatts.

Of total public electrical energy produced during 1987-88 hydro-electric sources provided approximately 11 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.

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. The Snowy Mountains Scheme is a dual purpose complex which supplies water for generation and irrigation. It is located in south-eastern Australia, and on its completion was one of the largest engineering works of its type in the world. It impounds the south-flowing waters of the Snowy River and its tributary, the Eucumbene, at high elevations and diverts them inland to the Murray and Murrumbidgee Rivers through two tunnel systems driven through the Snowy Mountains. The Scheme also involves the regulation and utilisation of the headwaters of the Murrumbidgee, Tumut, Tooma and Geehi Rivers. The diverted waters fall some 800 metres and together with regulated flows in the Geehi and Tumut River catchments generate mainly peak load electricity for the States of New South Wales 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 the Energy Chapter of *Year Book* No. 70.

New South Wales

Department of Minerals and Energy

On 19 October 1989 the Department of Minerals and Energy was established by the amalgamation of the department of Mineral Resources and the Department of Energy. The aim of the Department of Minerals and Energy is to promote the responsible development, management and utilisation of the energy resources of New South Wales.

The *Energy Administration Act 1987* confers broad powers on the Department to secure the best management of the supply and use of energy in New South Wales. This involves overseeing the planning of additional electricity supply capacity and of the supply and distribution of electricity, gas and petroleum products. The Department also promotes the efficient and safe use of energy in business, transport and residential sectors.

The State Energy Research and Development Fund (SERDF) was established by the *Gas Act 1986*. The Fund which is administered by the Department of Minerals and Energy provides financial support for the development, demonstration and commercialisation of new energy technologies, manufacturing processes and techniques likely to benefit NSW.

SERDF is funded by contributors from the gas and electricity industries with \$5.2 million available to the Fund in 1987-88, the first full year of operation.

In 1987-88, the Department undertook or funded a range of R&D projects and programs mainly in the areas of solar and wind technologies, coal and wastes utilisation, energy end-use efficiency, energy planning and electricity technology. Amounts spent or committed in these areas totalled \$3.6 million.

The Department also administers the Electricity Development Fund (EDF) established under the Electricity Act on 1 July 1987. Through the EDF, the Minister for Minerals and Energy arranges financial transfers between electricity supply authorities which provide financial support to County Councils to assist them to maintain their supply system and to implement various tariff rationalisation measures introduced by the State Government. The subsidy in the year ended June 1988 amounted to \$34 million. The EDF is also used, inter alia, to meet premiums for a joint electricity distribution industry general liability insurance coverage.

The Department continues to administer the Rural Electricity Subsidy Scheme, new approvals for which terminated on 30 June 1982. Under the scheme, the rural electrical development of the State has now been virtually completed in areas where the extension of supply is currently economically feasible. Electricity supply authorities receive subsidies towards the cost of new rural lines. At 30 June 1988 the scheme was committed to the payment of \$46,924,963 in subsidies, of which \$44,206,708 had been paid.

The Traffic Route Lighting Subsidy Scheme provides for financial assistance to councils towards the cost of installation of improved lighting on traffic routes traversing built-up areas with the objective of reducing the incidence of road accidents at night. For the year ended 30 June 1988, \$4.5 million was provided in subsidy payments for this scheme.

Electricity Commission of New South Wales and electricity supply authorities

The main function of the Commission is the generation and transmission of electricity, which it sells in bulk to distributing authorities (mainly local government bodies) throughout a large part of the State, to the government railways and to certain large industrial consumers.

As the principal generating authority, it is also responsible for the development of major new power sources except in the Snowy Mountains region.

The retail sale of electricity to the public is, in general, carried out by separate electricity supply authorities. At 30 June 1988 there were 27 retail supply authorities, mainly county councils, throughout the State.

Generation and transmission

Of the State's electrical power requirements during the year ended 30 June 1988, almost all was generated in New South Wales. Over 95 per cent was produced by the six major thermal power stations, with the balance from the Snowy Mountains Hydro-Electric Authority, other hydro-electric stations, and interchange with other States.

At 30 June 1987, the major power stations of the Electricity Commission of New South Wales State system and their effective capacities were as follows: Bayswater (Hunter Valley) 2,640 MW; Liddell (Hunter Valley) 1,860 MW; Munmorah (Tuggerah Lakes) 1,200 MW; Vales Point (Lake Macquarie) 1,880 MW; Eraring (Lake Macquarie) 2,640 MW; and Wallerawang (near Lithgow) 1,030 MW. The total nominal capacity of the Electricity Commission's system as at 30 June 1988 was 12,137 MW. The greater part of the Commission's generating plant is concentrated within a 185 km radius of Sydney. The maximum demand for electricity from the Commission's system during 1987-88 was 8,969 MW.

Several local government bodies operate their own power stations and generate a portion of their requirements which is supplemented by interconnection with the system of the Electricity Commission. The aggregate effective capacity for the whole of New South Wales systems and isolated plants was approximately 12,172 MW at 30 June 1988 while the number of retail consumers at this date was 2,324,412.

The retailing of electricity to 97 per cent of the population of New South Wales is in the hands of local distributing authorities, which obtain electricity in bulk from the Commission's major State network. This 17,000 km network of 500 kV, 330 kV, 220 kV, 132 kV, 66 kV and some 33 kV transmission lines links the Commission's power stations with the major load centres at Sydney, Newcastle and Wollongong and throughout much of the remainder of the State extending geographically over 650 kilometres inland.

New developments

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 for the early 1990s.

Bayswater Power Station, the largest in New South Wales, with a capacity 2,640 MW was officially opened on 9 October 1987.

A 153 km transmission line between Wagga Wagga and Darlington Point and Buronga joined the Broken Hill supplies to the New South Wales system.

Hydro-electricity

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

Gas reticulation

Natural gas (NG) was made available to Sydney consumers with the completion of an overland supply pipeline from the Moomba field in South Australia in 1976. During the following five years, lateral pipelines were completed to Wollongong (1978), Bowral-Mittagong (1979), Goulburn (1980) and Canberra, Queanbeyan and Wagga Wagga (1981). A major trunk line between Sydney and Newcastle was completed in 1982. A

lateral pipeline to Bathurst, Orange and Lithgow was completed in 1987, and Young was connected to natural gas in 1988.

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. By mid 1988, most of the Sydney homes with reticulated gas supply had been converted to the direct use of natural gas, with this program being scheduled for completion in 1990. At June 1988, Sydney users of direct and processed natural gas totalled about 395,000 residential accounts and 17,000 other users (mainly commercial/industrial).

A smaller 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 3 per cent of total sales in New South Wales.

Work still in the development stages includes extraction of methane gas from coal seams south of Sydney and the investigation of potential bulk natural gas storage facilities adjacent to the main population centres.

Victoria

State Electricity Commission—SEC

The SEC is Australia's largest electricity supply authority and individual coal producer. It is a semi-government authority with the principal responsibility of generating or purchasing electricity for supply throughout Victoria. It may own, develop and operate brown coal open cuts and briquetting plants and develop the State's hydro-electric resources. It is required to meet, from its own revenue, all expenditure involved with operating its power and fuel undertakings and to provide for statutory transfers to the consolidated revenue of the State. In 1988-89 its revenue was \$2,404.7 million. At 30 June 1989 it had total fixed assets of \$8,685 million and a staff of 21,551.

The SEC was established by an Act of the Victorian Parliament in 1921 and now operates under the *State Electricity Commission Act 1958*. Since it began operating, the SEC has expanded and coordinated the generation, purchase and supply of electricity on a State-wide basis to the stage where its system provides almost all the electricity produced in Victoria and its transmission covers almost the entire population of the State. At 30 June 1989 it distributed electricity directly to 1,555,000 customers and indirectly to a further 286,500 through 11 metropolitan councils which buy power in bulk for retail distribution under franchises granted by the Victorian Government before the SEC's establishment.

Existing electricity system

The State Electricity Commission Act requires the SEC to apply the natural resources of the State. Of the State's recoverable fossil fuel reserves, brown coal represents 95.0 per cent, natural gas 2.6 per cent and oil 2.4 per cent. The SEC therefore has committed itself to increasing the proportion of total Victorian requirements met with coal based energy.

Victoria's electricity system is based upon the State's extensive brown coal resource in the Latrobe Valley, 140 to 180 km east of Melbourne in central Gippsland. It is one of the largest single brown coal deposits in the world, amounting to 200,000 megatonnes, of which 52,000 are presently economically recoverable.

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

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) and Yallourn 'E' (240 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), Dartmouth (150 MW) and Eildon-Rubicon-Cairn Curran (135 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 1989 was 7,763 MW, including both capacity within the State and that available to it from New South Wales. In 1988-89 electricity generated by the SEC in its thermal and hydro-electric power stations, or purchased, totalled 36,144 GWh.

Power station construction

The fourth and final unit of Loy Yang 'A' Power Station was put into commercial service on 30 November 1988, taking the total installed plant capacity to 2,000 MW. The Loy Yang project will provide base load electricity for the Victorian Grid and is almost half the State's generating capacity.

The Loy Yang 'B' station, the second part of the project, has at this stage approved capacity of 1,000 MW in two units of 500 MW each. The first steam to turbine dates for units 1 and 2 are targeted for November 1992 and 1994 respectively. Work is on schedule to achieve these dates.

Transmission distribution—power grid

The Power Grid Group was formed during October 1988, to replace the Transmission Group. It has adopted the responsibility for design, construction, operation and maintenance of the transmission and sub-transmission systems. Main transmission is by 500, 330, 220 and 66 kV lines which supply the principal sub-transmission centres and interconnection between generating sources.

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

There have been steady progress made on Power Grids major projects in the last 12 months. As part of the South Australian interconnection, good progress is being made with the establishment of the Heywood Terminal Station, near Portland in the south-west of the State.

The Heywood Station provides the connection to existing 500 kV lines to the Portland Smelter and transformation to 275 kV for the connection of lines to South Australia. Commercial service is expected to be around March 1990.

In an effort to meet the increased load requirements for the North Eastern Region a new 22 kV substation has been constructed and will be in service this financial year.

Gas reticulation

The Gas and Fuel Corporation of Victoria is the largest gas undertaking in Australia, the sole reticulator of gas in Victoria, and a major marketer of liquefied petroleum gas (LPG). Constituted on 6 December 1950, it was formed by merging the interests of the

privately-owned Metropolitan and Brighton Gas Companies with the State Government. (Through its predecessor, the Metropolitan, the Corporation is descended from the first gas company in Victoria—The City of Melbourne Gas and Coke Company founded in 1850 and incorporated in 1853.)

The merger gave the newly-formed Corporation an unusual status—that of a public authority owned jointly by the State and private shareholders. With its expanded capital structure, the Corporation was able to build a plant at Morwell to gasify indigenous brown coal, with the objective of improving Victoria's gas supply. Commissioned in 1956, the Lurgi high pressure brown coal gasification works supplemented metropolitan gas production until the introduction of natural gas in 1969.

Commercial reserves of natural gas were discovered in the off-shore Gippsland Basin in 1965 by Esso-BHP from which the Corporation purchases, under agreement, the State's natural gas requirements.

Supply is drawn from the Marlin, Barracouta, and Snapper fields in Bass Strait, and transported by pipeline to an onshore treatment plant at Longford, near Sale. Before it enters the Corporation's transmission system, an odorant is added to give the gas a distinctive smell, for safety reasons.

The Corporation reticulates gas, 99 per cent of which is natural gas, through a 20,000 kilometre network of underground transmission pipelines and mains to more than one million industrial, commercial, and domestic consumers.

Queensland

Electricity reticulation

The electricity supply industry is administered by the *Queensland Electricity Act 1976–1989*. The industry operates under a two-tier structure consisting of the Queensland Electricity Commission and seven electricity boards.

The boards purchase electricity in bulk from the Commission and manage distribution systems within their respective areas to supply power to end use customers.

Each of the distribution authorities is directed by a five member board appointed by the Government. The Electricity Commissioner is an *ex officio* member, the other four members are residents within the board's area of supply. Electricity boards report to the Minister through the Queensland Electricity Commission.

The Commission has extensive regulatory and coordination roles. It coordinates the planning, establishes future capital spending by confirmation of budgets, and sets the retail rates charged to electricity users. The Commission also has responsibility for electrical safety and licensing of electrical workers.

The Commission plans, constructs and manages the generation and transmission operation that provides electricity to the whole of the State.

Electricity generation, transmission and distribution

There are four coal-fired generating plant sites on the system. These stations provide 97 per cent of energy requirements. Over 60 per cent of the rated capacity of this plant has been installed during the 1980s. The average age of all thermal plants is 8.4 years. The efficient operation and high availability of these stations and the decommissioning of older, small capacity plant has produced cost savings reflected in retail prices. Hydro-electric, pumped storage hydro-electric, and gas turbine plants make up the remainder. There are two hydro-electric power stations in the north of the State with a combined capacity of 132 MW. A pumped storage hydro-electric power station rated at 500 MW, located on the Brisbane River at Wivenhoe, is used to augment supply at peak demand and to pump water to high storage at times of low demand.

The transmission system extends over 1,500 kilometres, linking power stations to high voltage substations supplying the reticulation system. The highest transmission voltage is at 275 kV. In rural areas, extensive use is made of single wire earth return systems to supply relatively light loads over long distances. The circuit length of supply line extends over 174,000 kilometres, and has grown at an average rate of 3.8 per cent per annum over the last five years.

New development

The next addition to the State's generation capacity will be commissioned during 1993. This station, at Stanwell near Rockhampton, will be equipped with four turbo generators each rated at 350 MW. Coal will be railed to the station from a mine about 150 kilometres away, and the supply of cooling water for the station involves construction of a weir across the Fitzroy River and a 28 kilometre pipeline to the site.

The Tully-Millstream hydro-electric scheme will meet energy demand growth in the late 1990s. The scheme involves construction of a 600 MW underground station with three generating units, two major dams, and several smaller dams and weirs, a pumping station, and 20 kilometres of tunnels. Present projections of demand indicate that the station should take up load in 1997, but actual timing will remain under review.

Gas reticulation

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 1988 there were over 2,995 kilometres of mains laid in these centres and the systems serviced 161,686 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 in 1987-88 were 19,821 TJ compared with 17,056 TJ in 1986-87. Sales of reformed town gas were 1,155 TJ and 1,099 TJ respectively.

Western Australia

State Energy Commission of Western Australia

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

Electricity generation and distribution

The Commission 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. There are 20 MW capacity gas turbine generating units at Geraldton, Kalgoorlie and Kwinana. An additional three 36 MW gas turbine generating units (two near Geraldton and one at Kalgoorlie) are in the process of being commissioned.

Two power grid systems operate in Western Australia and 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. The gas turbines at Kwinana, Kalgoorlie and Geraldton provide back-up supplies. 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 was brought into the South-West grid system in 1984 following construction of a 680 km transmission line from Muja, one of the longest radial feed lines constructed in Australia.

- *The Pilbara interconnected system.* This system was established during 1985–86 and interconnects Karratha, Dampier, Cape Lambert, Wickham, Roebourne and Port Hedland. 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 supplies come from the Commission's stand-by diesel power generating facility at Redbank (Port Hedland) or from Hamersley Iron Pty Ltd's power station at Dampier.

In areas too remote to utilise the interconnected grid systems, the Commission operates 29 diesel power stations and provides support services for the Federal Department of Aboriginal Affairs to help run 37 Aboriginal village power stations.

At 30 June 1988, the Commission's generating capacity from its interconnected grid system was 2,100 MW, while the capacity of its supply system in country areas was 172 MW. There were 585,020 customer accounts for electricity throughout the State.

Gas reticulation

The Commission is the main supplier of gas in Western Australia. It owns and operates the Dampier to Bunbury natural gas pipeline which feeds North West Shelf gas into an extensive reticulation system in the Perth metropolitan area as well as smaller country reticulation systems at Geraldton and Carnarvon to the north and Pinjarra and Bunbury in the south-west. The Commission also reticulates tempered liquefied petroleum (TLP) gas through a local system at Albany on the south coast.

At 30 June 1988, there were 208,205 customer accounts for natural gas and 2,409 customer accounts for TLP gas.

South Australia

Electricity Trust of South Australia

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

Capacity and production

At 30 June 1989, the Electricity Trust's installed capacity was 2,680 MW. Its major power stations are Port Augusta Northern Power Station (500 MW), Torrens Island (1,280 MW) and Port Augusta Playford 'B' (240 MW). Of the older stations, Playford 'A' (90 MW) has been retired and most of Osborne (240 MW) has been placed on cold storage. 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 Trust supplies approximately 650,000 customers, accounting for over 95 per cent of all electricity consumers in the State.

The two main fuels used by the Trust are coal from Leigh Creek for the Port Augusta power stations and natural gas from the Cooper Basin for the Torrens Island, Dry Creek and Mintaro stations.

Future developments

To meet future demands, a third 250 MW unit at the Northern Power Station, also fuelled by Leigh Creek coal, is scheduled for commissioning in 1996.

A 500 MW capacity interconnection with the Victorian–New South Wales systems, being constructed, is scheduled for commissioning in 1990.

Gas reticulation

The South Australian Gas Company (SAGASCO) was a privately owned company incorporated by an Act of Parliament in 1861. The first gas was produced at Brompton in 1863.

When natural gas became available from the Cooper Basin in the late 1960s, SAGASCO, in 1966, contracted a supply of this indigenous fuel. Deliveries commenced in 1969 and, with the complete conversion of the metropolitan area to natural gas in January 1971, coal carbonising and carburetted water gas plants were shut down.

Under the 1966 contract, SAGASCO paid the Cooper Basin producers who, in turn, paid the transportation charge of the Natural Gas Pipelines Authority. In 1974, major changes to contracts and other arrangements were effected. The Pipelines Authority—renamed the Pipelines Authority of South Australia (PASA)—became responsible for purchasing gas at the Cooper Basin and on-selling to customers. The 1966 contract was shortened to expire on 1 January 1988, from which date a new supply contract with PASA took effect.

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

The company places great emphasis on promoting natural gas with both the domestic and commercial/industrial markets as a cheap and non-polluting fuel. On 1 June 1988 the South Australian Gas Company merged with the South Australian Oil and Gas Corporation to form SAGASCO Holdings Ltd. Two new subsidiaries were formed: South Australian Gas Company Ltd (to undertake the operations of the old utility) and SAGASCO Resources Ltd. The sales and distribution of LPG is now handled by a new company, SAGASCO LPG Pty Ltd.

Tasmania**Electricity**

Hydro-electric power accounts for almost all reticulated energy in Tasmania. An even distribution of rainfall throughout the year and the establishment of numerous dams in the central Highlands, has created substantial artificial storage which has enabled the State to produce electricity at a lower cost than elsewhere in Australia.

Capacity and Transmission

Electricity is supplied by the Hydro-Electric Commission which was created in 1930. The total installed generator capacity at 30 June 1989 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.

Construction is continuing on two more hydro power schemes in western Tasmania. These are the King River Power Development, scheduled for completion in mid 1992, and the Anthony Power Development, expected to be completed some 18 months later. They will add 227 MW to the installed capacity of the system.

During the 1988–89 financial year total energy generated was 8,908.5 MWh, a slight increase on the previous year. Total sales amounted to 8,225 MWh of which 66 per cent was sold to the major industrial sector.

Total water storages at June 1989 were 35.9 per cent compared with 29 per cent at June 1988. Rainfall in October 1988 boosted storage by a remarkable 10.8 per cent.

Gas reticulation

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 is a Statutory Authority, created on 1 July 1987, with responsibility for the sale of natural gas, generation, distribution, transmission and sale of electricity, and water and sewerage services.

In Darwin, the major electricity source is the gas-fired Channel Island Power Station completed in October 1987 with a capacity of 186 MW. In Alice Springs, power is generated at the Ron Goodwin Power Station which operates on natural gas. In Katherine, electricity is generated at the gas fired Katherine Power Station, completed in September 1987. Natural gas is also used as a fuel for electricity generation at the Tennant Creek Power Station and in February 1989 a gas fired power station was commissioned for Pine Creek.

A natural gas pipeline from the Amadeus Basin in Central Australia to Darwin was completed in December 1986, enabling electricity generation in Darwin, Katherine and Tennant Creek to use an indigenous fuel to replace expensive, imported fuel. The Alice Springs Power Station is fuelled by natural gas from Palm Valley via a separate pipeline.

Many small communities in the Territory generate their own power using diesel-fired generating sets. Hybrid diesel-battery units are being trialled in six locations

Australian Capital Territory

Electricity distribution

Electricity is distributed within the Territory by ACT Electricity and Water. This authority was established on 1 July 1988 taking over from the previous ACT Electricity Authority. During the year 1988-89 the total bulk electricity purchased was 2,075 GWh, comprised of 1,405 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 514 MW. The authority supplied 104,236 customers at 30 June 1989.

Gas reticulation

Reticulated gas first became available in the Australian Capital Territory in January 1982. 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. AGL Canberra Ltd has invested capital of \$83 million to set up the infrastructure necessary to service and support a major utility and, to date, has laid over 2,000 kilometres of gas mains, bringing reticulated natural gas within reach of an estimated 68,000 dwellings in 74 suburbs.

During 1988-89, AGL Canberra Ltd reticulated 2,748 TJ of natural gas to 900 commercial and industrial establishments and about 20,800 homes. Over the next five years the company expects to invest a further \$50 million and, in the long term, over 2,500 kilometres of gas mains will service over 50,000 customers in the Territory.

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