

ENERGY AND MINERALS

DEPARTMENT OF MINERALS AND ENERGY

In December 1976, the Victorian Parliament passed the *Minerals and Energy Act 1976*. It was assented to on 16 December 1976 and was proclaimed to operate from 1 September 1977. The Act provides for the amalgamation of the Ministry of Fuel and Power and the Mines Department into a Department of Minerals and Energy responsible to the Minister for Minerals and Energy. The *Fuel and Power Act 1965* was repealed and the Ministry of Fuel and Power abolished. The Mines Department was absorbed into the new Department. However, all legislation relating to mining and energy in the State remains in force and the provisions of the *Pipelines Act 1967* are now administered by the new Department in its entirety.

Other legislation administered by the Department includes the *Mines Act 1958*, *Petroleum Act 1958*, *Extractive Industries Act 1966*, *Petroleum (Submerged Lands) Act 1967*, *Groundwater Act 1969*, *Coal Mines Act 1958*, and *Mining Development Act 1958*. The Department also plays an important role in the functioning of the *Environment Protection Act 1970* and the *Land Conservation Act 1970*.

The Minister for Minerals and Energy is the designated authority under the *Petroleum (Submerged Lands) Act 1967* and will continue to be responsible for the operation of the State Electricity Commission of Victoria and the Gas and Fuel Corporation of Victoria. Thus all legislation and activities relating to energy and mining in the State will come under the direct jurisdiction of a single Minister for Minerals and Energy.

The Department of Minerals and Energy is responsible for the co-ordination of energy research and the formulation of energy policies for Victoria, particularly in relation to petroleum and brown coal.

The Victorian Brown Coal Research and Development Committee operates within the Department. It was established in 1975 for the purpose of studying all aspects of the development of Victoria's brown coal resources, other than electricity generation, with particular emphasis on the production of liquid hydrocarbons. A Victorian Solar Energy Committee was formed during 1977 for the purpose of advising the Government on this form of energy.

The petroleum (offshore and onshore), pipeline, mining, construction, excavation, and extractive industries are regulated, ensuring that they are developed and conducted in a safe and effective manner. The Department also regulates the production, transportation, storage, and usage of explosives, inflammable liquids, gas, and liquid petroleum gas. The Geological Survey Division conducts field surveys and regional exploration, and produces geological maps and technical reports which increase understanding of the geology, petroleum, mineral, stone, and groundwater potential of the State.

Deep drilling to establish groundwater resources for town water supply purposes is undertaken, as are various other shallow drilling programmes. Core and cuttings from drilling operations are retained in a core library and a geological museum and comprehensive library are maintained. Technical and drilling assistance and loans or grants are considered for exploration, prospecting, and approved development projects. Assays and analyses of natural products are undertaken by the chemical branch of the Department, who also offer advice on mineral problems of a chemical nature. Stamp

batteries are maintained at five country locations to enable trial crushings to be made for the benefit of prospectors. The Department also undertakes certain reclamation projects on abandoned mines and the capping or filling of disused shafts on Crown land.

Further reference: *Victorian Year Book* 1978, pp. 295-7

ENERGY

General

In 1976-77, about 86 per cent of Victoria's electricity needs were produced by the brown coal fired generating stations situated in the coal fields in the La Trobe valley. A further 5 per cent of Victoria's electricity requirements is currently generated in hydro power stations located in the north-eastern ranges of the State and 10 per cent is obtained from the Snowy Mountains Hydro-Electric Scheme in New South Wales.

About 82 per cent of Victoria's petroleum refinery crude oil input comes from the State's offshore oil fields and the balance is derived from crude oil imported from the Middle East.

During recent years, natural gas has assumed an increasingly important role in the supply of energy in Victoria. Currently it provides about 16 per cent of Victoria's primary energy needs. Over 99 per cent of all gas used in Victoria for domestic and industrial purposes is produced from the offshore gas and oil fields in Bass Strait. It is estimated that this resource is adequate to provide Victoria's needs for the next 30 years. There is a small but steadily increasing use of liquefied petroleum gas (propane, butane) derived from refineries and the Bass Strait oil and gas fields.

VICTORIA—SOURCE OF PRIMARY ENERGY, 1976-77

Source	Per cent
Crude oil	42.3
Brown coal	40.2
Natural gas (including LPG)	15.5
Hydro power	1.4
Wood	0.6
Total	100.0

Source: Department of Minerals and Energy.

Brown Coal

Location

Victoria's largest resources of fossil fuels are the huge deposits of brown coal in the La Trobe valley. These extend over an area ranging from 140 kilometres to 200 kilometres east of Melbourne in the central Gippsland region. These deposits, which form the bulk of primary energy available to the State, are among the largest in the world. Smaller deposits exist in other areas in south Gippsland, in south eastern Victoria at Gelliondale and in the south-central region at Anglesea, Bacchus Marsh, and Altona. These deposits, although extensive, do not compare in magnitude and importance to those in the La Trobe valley and comprise only about 5 per cent of the total resource in the State. A map of brown coal areas of Victoria can be found on page 298 of the *Victorian Year Book* 1978.

Resources

The resources of brown coal in Victoria total about 114,000 megatonnes. This is the current geological assessment but as a result of continuing drilling programmes, knowledge of these resources is gradually being increased as more deposits are revealed in areas not yet fully explored, particularly in the eastern part of the coal bearing area of the La Trobe valley in central Gippsland.

The resources which have been proven as potentially economically recoverable are classified as reserves. The inferred or estimated balance are marginal or sub-marginal reserves but are classified as part of the total resource. This is illustrated in the following table:

VICTORIA—GEOLOGICAL RESOURCES OF BROWN COAL
(megatonnes)

Area	Reserves proved	Marginal (inferred) reserves	Total resources
Eastern Victoria—			
La Trobe valley	(a) 64,923	(a) 42,923	(a) 107,846
Stradbroke (b), Won Wron	502	—	502
Gelliondale	1,321	4,093	5,414
	66,746	47,016	113,762
South-central Victoria (c)—			
Anglesea	Insufficiently delineated		115
Bacchus Marsh	Insufficiently delineated		100
Altona (d)	Possibly extensive but not defined		..
			215
Total			113,977

(a) Comprises marginal and sub-marginal reserves as part of total resources.

(b) Delineation drilling of Stradbroke field by Department of Minerals and Energy still in progress in late 1978.

(c) No delineation drilling for several years.

(d) Difficult to assess as resource is covered by thick lava flows of basalt and by sediments and would be uneconomic at present.

Sources: State Electricity Commission of Victoria, and Department of Minerals and Energy, Victoria, 1977-78.

La Trobe valley fields

The brown coal seams in the La Trobe valley range in geological age from Eocene to Early Miocene and are therefore between 50 and 20 million years old.

The brown coal reserves in the valley comprise about 65,000 megatonnes proven and 43,000 megatonnes inferred (marginal and sub-marginal). About 35,000 megatonnes or 54 per cent of the proven reserves occur in areas where the overburden over the uppermost seam is less than 30.5 metres while 62,000 megatonnes or 95 per cent is in areas with less than 91.4 metres of overburden. The inferred reserves of 43,000 megatonnes in the La Trobe valley are mostly deeper and less accessible with only about 3 per cent occurring in areas with less than 30.5 metres of overburden.

Thick coal seams occur close to the surface in the two large areas known as the Yallourn-Morwell and the Loy Yang coalfields and in several smaller areas subject to verification. The Yallourn-Morwell coalfield is split into the Yallourn-Maryvale and the Morwell-Narracan fields by the town of Morwell and the services corridor containing the Princes Highway and the East Gippsland rail line. Using the open-cut techniques currently in use, about 12,000 megatonnes can be readily recovered at approximately 1976 costs for the purpose of power generation and briquette manufacture.

Other fields

Stradbroke

This is a newly discovered field in the Strzelecki Ranges adjacent to the southern flank of the La Trobe valley with estimated reserves of 500 megatonnes which are in the economically winnable category. Drilling is continuing.

Gelliondale

The Gelliondale coalfield is located beneath the flat coastal plain adjacent to the south Gippsland highlands. The boundaries of the field have not been clearly defined, but an area approximately 10 kilometres and 2.5 to 4 kilometres wide has been closely drilled and shown to contain an important economic coalfield. The deposit is second in size to the La Trobe valley. Proved and inferred reserves total about 5,000 megatonnes of which readily recoverable reserves are estimated at 400 megatonnes.

Production, 1977-1978

During the period 1 July 1977 to 30 June 1978, 30.49 megatonnes of brown coal was mined in Victoria. Of this quantity 29.38 megatonnes was won by the State Electricity Commission of Victoria from the La Trobe valley fields and 1.11 megatonnes by two privately owned companies in the south-central region (Anglesea and Bacchus Marsh).

The principal use for brown coal mined in Victoria is for the generation of electricity, 26.32 megatonnes being used in 1977-78 for this purpose. Only about 2.85 megatonnes was used during the same period for other purposes such as briquette manufacture and steam raising. During the year ending 30 June 1978, the State Electricity Commission of Victoria won 29.38 megatonnes of brown coal from the three open cuts it currently operates in the La Trobe valley.

Other uses for brown coal

Briquettes

Raw brown coal is treated and compressed into regular shaped pellets of a convenient size called briquettes to produce a high grade solid fuel having a moisture content of about 15 per cent. Briquettes are transported more economically than raw coal for industrial and domestic use. They are also used in power stations as a fuel stock for the production of char and can be used to produce liquid hydrocarbons.

Only coal from the Yallourn open cut is used for making briquettes as it is the highest quality coal available in the La Trobe valley. Approximately 3 tonnes of raw coal are used to produce a tonne of briquettes and about 1 tonne of brown coal is used for raising steam used in the process of manufacturing 1 tonne of briquettes. The annual production of briquettes reached a peak of 1.9 million tonnes during 1966 but with the advent of natural gas declined to 1,035,000 tonnes in 1977.

Char

Char is a form of high-grade carbon made by the carbonisation of brown coal. It can be used as a source of carbon or as a reducing agent in chemical and metallurgical industries. There are two privately owned plants operating in Victoria at present for the production of char. Both are in the La Trobe valley and both purchase briquettes and small amounts of brown coal from the State Electricity Commission. The larger plant, at Morwell, has an output capacity of 60,000 tonnes a year.

Further reference: *Victorian Year Book 1971*, pp. 359-62

Electricity

State Electricity Commission of Victoria

The most widely used and extensively distributed form of energy in Victoria is electricity. This is generated and distributed by the State Electricity Commission of Victoria, a public utility formed by an Act of the Victorian Parliament in 1920. Since it was formed the Commission has expanded and co-ordinated the generation, transmission, and supply of electricity on a State-wide basis to the point where it now produces all of the electricity generated in Victoria available for public supply.

At 30 June 1978, the Commission with 19,308 personnel and capital assets of \$2,328m distributed electricity to 1,243,300 consumers throughout Victoria. In addition, eleven metropolitan municipal councils purchased electricity in bulk from the Commission for retail distribution to a further 269,000 customers. Over 119,000 kilometres of power lines are used by the State Electricity Commission of Victoria and the municipal networks.

Other electricity producers

A 150 MW power station owned and operated by Alcoa of Australia Ltd produces electricity using brown coal found as a fossil fuel at Anglesea in south central Victoria to supply the company's alumina smelter at Point Henry in Port Phillip Bay. A number of other industrial enterprises such as the Shell Refinery at Corio generate electricity within their own plant.

Existing electricity system

The development of Victoria's electricity system is based on the utilisation of Victoria's extensive brown coal resources in the La Trobe valley in central Gippsland about 140 kilometres east of Melbourne with supplementary development of hydro sources in north-eastern Victoria. Victoria is entitled to receive one third (New South Wales receives two thirds) of the electricity generated in the Snowy Mountains Hydro-Electric Scheme after the Commonwealth Government's requirements for the Australian Capital Territory have

been met. Victoria also shares with New South Wales the electricity generated at the Hume hydro station near Albury on the Murray River.

In 1977-78, 86 per cent of Victoria's electricity needs was generated from brown coal. Brown coal is also manufactured into a high quality fuel in the form of briquettes. About 17 per cent of these are consumed in power stations, the balance being sold to industry and for domestic purposes.

The major station in the Commission's interconnected system is the 1,600 MW brown coal fired power station at Hazelwood which alone generates nearly 50 per cent of Victoria's electricity. The other brown coal fired, base load power stations in the interconnected system are Yallourn, Morwell, and Yallourn "W".

There are also steam stations in Melbourne (Newport, Richmond, and Spencer Street), and hydro-electric stations at Kiewa and Eildon, on the Rubicon and Royston Rivers near Eildon, and at Cairn Curran on the Loddon River near Bendigo.

VICTORIA—POWER STATIONS: LOCATION, RATING, AND PRODUCTION

Station	Maximum continuous rating (a)	Electricity production							
		1974-75		1975-76		1976-77		1977-78	
		Quantity	Percentage of production	Quantity	Percentage of production	Quantity	Percentage of production	Quantity	Percentage of production
MW	Mill kWh		Mill kWh		Mill kWh		Mill kWh		
Thermal stations—									
Hazelwood	1,600	8,238.0	48.4	9,132.2	50.9	9,534.3	50.1	9,228.3	47.3
Yallourn	546	2,545.1	14.9	2,360.7	13.2	2,939.5	15.4	2,183.9	11.2
Yallourn "W"	700	2,409.0	14.2	3,538.9	19.7	3,021.2	15.9	4,204.0	21.5
Morwell	170	1,263.7	7.4	1,165.3	6.5	1,159.3	6.1	830.1	4.2
Newport	198	136.6	0.8	133.4	0.7	270.1	1.4	306.4	1.6
Spencer Street (b)	90	1.0	—	1.2	—	41.1	0.2	109.9	0.6
Richmond	38	0.1	—	0.2	—	10.5	0.1	54.7	0.3
Red Cliffs (c)	—	0.1	—	—	—	—	—	—	—
Total SEC thermal	3,342	14,593.6	85.7	16,331.9	91.0	16,976.0	89.2	16,917.3	86.7
Hydro Stations—									
Kiewa (d)	184	451.9	2.6	394.3	2.2	259.8	1.4	251.5	1.3
Eildon (e)	135	539.1	3.2	415.5	2.3	278.4	1.4	263.0	1.3
Total SEC hydro	319	991.0	5.8	809.8	4.5	538.2	2.8	514.5	2.6
Total SEC	3,661	15,584.6	91.5	17,141.7	95.5	17,514.2	92.0	17,431.8	89.3
Net purchases	—	1,448.3	8.5	803.7	4.5	1,521.7	8.0	2,077.0	10.7
Total	3,661	17,032.9	100.0	17,945.4	100.0	19,035.9	100.0	19,508.8	100.0

(a) At 30 June 1976.

(b) Melbourne City Council station.

(c) Retired April 1975.

(d) McKay Creek, West Kiewa, and Clover.

(e) Eildon, Rubicon, Lower Rubicon, Royston, Rubicon Falls, and Cairn Curran.

Source: State Electricity Commission of Victoria.

Transmission and distribution

The electrification of Victoria has been virtually completed except for some isolated properties in remote parts of Victoria. The Commission supplies electricity in bulk to eleven municipal undertakings which operate as separate supply authorities under franchises granted before the Commission was established.

The electrical transmission and distribution system in the State supply network at 30 June 1978 comprised over 119,000 kilometres of power lines, 4 auto-transformation stations, 26 terminal receiving stations, 177 zone sub-stations, and over 80,000 distribution sub-stations. Main transmission is by 8,600 route kilometres of 500 kV, 330 kV, 220 kV, and 66 kV power lines which supply the principal distribution centres and also provide interconnection between generating sources. Electricity from Hazelwood is transmitted to the Melbourne area at 500 kV. A map of Victoria's main power transmission system can be found on page 301 of the *Victorian Year Book 1978*.

*New generating projects**Yallourn "W"*

Designed as a base load power station of 1,450 MW capacity, this station is being built in two stages at Yallourn West in the La Trobe valley. It was originally planned to comprise only 2 x 350 MW units when approved by the Victorian Government in 1965. The first was commissioned during the winter of 1973 and the second during the winter of 1975.

In 1972, the Victorian Parliament approved a proposal to extend the Yallourn "W" power station by the addition of two generating units. Each will have a capacity of 375 MW. Site works commenced in 1975 and the two new generators are expected to be in service in the early 1980s.

Newport

The Victorian Government has authorised the State Electricity Commission to build a 500 MW regulating power station at the mouth of the Yarra River and construction is proceeding.

Jeeralang

The Commission is installing 465 MW of gas turbine plant using natural gas at Jeeralang, near Morwell in the La Trobe valley, to provide additional generating capacity to compensate for the expected shortage in supply which will be caused through the delay in building the new Newport Station.

Dartmouth

The Commission is constructing a new hydro-electric power station comprising a single 150 MW generator at Dartmouth on the Mitta Mitta River in north-eastern Victoria. The station is scheduled to commence operating in 1980.

Loy Yang

In December 1976, the Victorian Government passed an Act of Parliament authorising the construction of a power station and open cut complex at Loy Yang, 7 kilometres south east of the City of Traralgon in the La Trobe valley in central Gippsland. The development will comprise two 2,000 MW power stations with the first station (Loy Yang "A") planned to come into service between 1983 and 1987 and the second power station (Loy Yang "B") programmed to come into service between 1989 and 1992. Site works for the project began early in 1977.

Petroleum

Petroleum products were first imported into Victoria from the United States of America in drums during the last few years of the nineteenth century. Victoria's first refinery was a small one erected at Laverton. It closed in 1955. In order to cope with a rapidly increasing demand for petroleum products after the Second World War, two major refineries were erected. The first of these was Shell Australia's refinery at Corio near Geelong which was commissioned in 1954 and the second was the Standard Vacuum refinery — now Petroleum Refineries (Australia) Pty Ltd, which commenced full scale operations at Altona in 1955. This latter event led to the closure of the small Laverton refinery. A third major refinery was built by BP Refinery (Westernport) Pty Ltd, at Crib Point in 1965. These three refineries, all of which are within a radius of 75 kilometres from the centre of Melbourne, currently satisfy almost the whole of Victoria's market for refined products.

*Discovery and development of indigenous oil and gas fields**Exploration in the Gippsland Basin, 1960 to 1978*

Exploration for petroleum has been almost a continuous operation in the offshore waters of eastern Bass Strait during the past 17 years. The work has been carried out principally by the partnership of Hematite Petroleum Pty Ltd, a wholly owned subsidiary of The Broken Hill Proprietary Co Ltd, and Esso Exploration and Production Australia Inc. through Esso Australia Ltd as the operator.

Development of the Gippsland fields, 1967 to 1978

Between 1967 and 1971, four of the commercial fields discovered offshore in the Gippsland Basin in eastern Victoria were developed as an integral operation. These were

the Barracouta and Marlin gas fields and the Halibut and Kingfish oilfields, together with a small oil reservoir in the Barracouta field. During 1972 and 1973, further development was carried out on the Marlin field following delays to the initial programme caused by a blow-out and a fire on the platform. At present, work on the development of the Mackerel field is well advanced. Drilling of the scheduled eighteen production wells has commenced and oil is being produced.

During the latter part of 1976, construction of the Tuna template was completed and it was erected on site about 56 kilometres offshore in January 1977. Work on the erection of the platform continued through 1977 and development drilling of the scheduled 18 wells commenced on 2 October 1978.

Production and transportation of crude oil, 1970 to 1977

The Barracouta oil reservoir, discovered during gas development drilling programmes in 1968, came on stream in October 1969, the Halibut field in April 1970, and the Kingfish field in March 1971. The crude oil from these three fields is stabilised at the Gippsland Gas Processing and Crude Oil Stabilisation Plant at Longford.

The stabilised crude is then conveyed through a pipeline to Long Island Point where it is stored in eight 268,000 barrel capacity tanks. From Long Island Point the crude oil is then taken by tankers to refineries in Sydney and Brisbane and by pipeline to Victoria's three refineries. The following table sets out the production of stabilised crude oil for the years 1972 to 1977:

VICTORIA—CRUDE OIL PRODUCTION, 1972-1977

Year	Barrels			Kilolitres		
	During year	Progressive production at 30 December	Average barrels/day for year	During year	Progressive production at 30 December	Average kilolitres day for year
1972	103,262,110	246,290,446	282,136	16,418,675	39,160,181	44,860
1973	127,089,311	373,379,757	348,190	20,207,200	59,367,381	55,362
1974	126,656,461	500,036,218	347,004	20,138,377	79,505,759	55,173
1975	136,434,598	636,470,816	373,793	21,693,101	101,198,860	59,433
1976	140,559,679	777,030,495	384,043	22,347,162	123,546,022	61,058
1977	145,187,523	922,218,018	397,774	23,074,930	146,620,952	63,219

Source: Esso Australia Ltd.

VICTORIA—GIPPSLAND BASIN COMMERCIAL HYDROCARBON RESERVES AND PRODUCTION, 1 JULY 1978

Item	Initial	Produced	Remaining	Initial	Produced	Remaining
	trillion (10 ¹²) cubic feet			billion (10 ⁹) cubic metres		
Natural gas	7.730	0.662	7.068	218.983	18.756	200.227
	million barrels			'000 kilolitres		
Crude oil	2,257	981	1,276	358,837	155,967	202,870
Condensate	211	15	196	33,548	2,385	31,163
Liquified petroleum gas	506	100	406	80,451	15,900	64,551

NOTE. All figures are for products after processing.

Crude oil = C₁ + in oil reservoir; Natural gas = C₁ and C₂;
Condensate = C₂ + dissolved in gas; LPG = C₃ and C₄.

Source: Department of Minerals and Energy, Victoria, 1978.

Refining

There are three refineries in Victoria: the Shell Refining (Australia) Pty Ltd at Corio near Geelong, the Petroleum Refineries (Australia) Pty Ltd at Altona, and the BP Refinery (Western Port) Pty Ltd at Crib Point, Western Port. Shell Refining (Australia) Pty Ltd also operates a plant at its Corio refinery for the production of lubricating oil.

Because the characteristics of Gippsland crude oil were different from that imported from the Middle East, the three refineries modified their processes when the local crude commenced to be used in 1970 and, in some instances, installed new plant. Refining capacity at June 1977 is set out in the following table:

VICTORIA—REFINING CAPACITY AT 30 JUNE 1977

	Location in Victoria and year it came on stream	Plant type (a)	Primary processing units (b)
Shell Refining (Australia) Pty Ltd	Corio near Geelong	1954	D 16,536-17,490 kl a stream day
			C (104,100-110,000BSD)
			L 5,406,000 tonnes/year
			B
Petroleum Refineries (Australia) Pty Ltd	Altona near Melbourne 1954	D	15,900 kl (100,000BSD)
		C	4,692,000 tonnes/year
		L	
		B	
BP Refinery (Western Port) Pty Ltd	Crib Point, on Western Port Bay 1966	D	9,540 kl a stream day
		B	(60,000BSD) 2,550,000 tonnes/year

(a) Keys to type of plant: D: distillation; C: cracker; L: lubricating oil; B: bitumen.
(b) BSD: barrels per stream day; kl: kilolitres.

In addition, the lubricating plant of Shell Refining (Australia) Pty Ltd at Corio has an output capacity of 350 kilolitres or 2,200 barrels per stream day. This is equivalent to 102,000 tonnes a year.

Each refinery also imports crude oil from the Middle East for the production of special products including bitumen, asphalt, and certain other heavy end products. A certain amount of light ends such as motor spirit and aviation jet fuel are also produced in the process of treating these imported crude oils.

Transportation

Indigenous crude oil is shipped by tanker from the Long Island Point and Crib Point jetties at Western Port to refineries in Sydney and Brisbane. The total volume shipped by tanker during the twelve months ending June 1977 was 65,163,480 barrels or 10,360,146 kilolitres, and 172 tanker movements were involved.

During the twelve months ending 30 June 1977, the three refineries obtained by pipeline 81,267,363 barrels or 12,920,457 kilolitres of Gippsland crude and imported 4,508,000 barrels or 716,740 kilolitres of crude from the Persian Gulf, making a total supply of 85,757,363 barrels or 13,637,197 kilolitres of crude oil feedstocks. During the calendar year 1977, the refineries imported by ship 1,082,000 barrels or 172,000 kilolitres of wholly or partially refined products from overseas or other States in Australia and exported by ship 33,042,000 barrels or 5,250,000 kilolitres of wholly or partially refined products to overseas destinations such as New Zealand and the Pacific Islands and to other States in Australia.

Marketing

Motor spirit in two grades — 98 octane (super grade) and 89 octane (standard grade) — and a wide range of other petroleum products are marketed in Victoria through a number of industry terminals and depots and 3,716 retail outlets (30 June 1977), the majority of which are operated by the nine major oil companies. At 30 June 1977, Victoria had the capacity to store 3,349,005 kilolitres of crude oil and petroleum products in bulk at 21 installations in Melbourne (14), Geelong (1), Crib Point (1), Long Island Point (1) and Portland (4), including refineries.

In 1977, a total of 8,510.43 thousand kilolitres or 26 per cent of the Australian total of the main petroleum fuels were marketed in Victoria's marketing area. The principal petroleum products marketed in 1977 are listed in the following table:

VICTORIA—PRINCIPAL PETROLEUM PRODUCTS MARKETED, 1977
(’000 kilolitres)

Item	Quantity	Item	Quantity
Aviation gasoline	19.40	Industrial diesel fuel —	
Motor spirit —		Inland	229.26
Super	3,555.74	Bunkers	119.24
Standard	459.16	Total	348.50
Total	4,014.90	Fuel oil —	
Power kerosene	6.36	Inland (a)	339.12
Aviation turbine fuel	391.11	Bunkers	559.79
Lighting kerosene	61.21	Total	898.91
Heating oil	455.66	Other petroleum fuels (b)	1,154.09
Automotive distillate —		Grand total	8,510.43
Inland	1,122.29		
Bunkers	38.00		
Total	1,160.29		

(a) Excluding refinery fuel.

(b) Including refinery fuel.

Source: Petroleum Branch, Department of National Development, Canberra.

Liquefied petroleum gas (propane and butane)

Liquefied petroleum gas (LPG) is produced by the Esso/BHP fractionation plant at Long Island Point and Victoria's three refineries. The Long Island facilities produce over 75 per cent of the total production of LPG in Victoria. The principal distributor in Victoria is the Gas and Fuel Corporation of Victoria which supplies over 700,000 customers by reticulation and by cylinder. A number of oil companies and other marketing companies distribute LPG throughout the State in accordance with the provisions of the *Gas Franchises Act 1970*. The establishment of the Long Island facilities is described in the 1977 and earlier editions of the *Victorian Year Book*.

Annual production of propane and butane at the Long Island Point plant is now approximately 1,348,000 tonnes. The total storage capacity at the plant comprises six tanks, each of 10,000 tonne capacity of either butane or propane and a 20,000 tonne capacity tank to store butane. Nearly all the production at Long Island Point is shipped to Japan.

Ethane gas

Ethane gas is produced at the Long Island Point Fractionation Plant and has since 1972 been conveyed through a pipeline to the Altona Petrochemical Company Limited at Altona. A new plant has been built for Hydrocarbon Products Proprietary Limited at West Footscray at a cost of \$60m.

Further reference: *Discovery and development of crude oil in Victoria, Victorian Year Book 1974, pp. 382-5*

Gas industry

The gas industry in Victoria is based on natural gas which provides about 99 per cent of all gas used by industry and for domestic purposes. During recent years the structure of the industry has changed considerably. In 1969, the Gas and Fuel Corporation of Victoria, a State instrumentality, and three privately owned gas companies operated the gas industry in the State. Since that time, the three companies have been taken over by the Gas and Fuel Corporation of Victoria, which is now the sole distributor of natural gas in Victoria. At 30 June 1978, reticulated gas was being supplied to customers in Victoria through a network of approximately 15,000 kilometres of transmission pipelines and reticulation mains.

Gas and Fuel Corporation of Victoria

The Gas and Fuel Corporation of Victoria was established under the provisions of the *Gas and Fuel Corporation Act 1950* as a joint enterprise combining the State of Victoria

with the shareholders of the Metropolitan Gas Company and the Brighton Gas Company. The purpose of the legislation was to provide the means for developing Victoria's brown coal resources for the production of gas, instead of using New South Wales black coal, and to consolidate and rationalise the gas industry by providing for the takeover and absorption by the Corporation of private or municipal gas utilities. The Corporation commenced operating on 1 January 1951 and, through the subsequent takeover of utilities which was authorised by legislation passed by the Victorian Parliament, became in 1974 the sole distributor of reticulated gas throughout Victoria.

Recent gas industry developments

The history of the discovery and development of the Gippsland Basin fields offshore in eastern Bass Strait is described in earlier editions of the *Victorian Year Book* and on pages 280-1 of this *Year Book*.

In 1974, the Esso/BHP partnership commenced a new stage of development of the Gippsland Basin fields. The first project to be undertaken was the enlarging of the Gippsland Gas Processing and Crude Oil Stabilisation Plant at Longford. A new gas plant, known as the Gippsland Gas Processing Plant No 2, was erected during 1974 and 1975 and commissioned in February 1976. It cost \$30m to build and is capable of treating 9.6 million cubic metres of gas a day. The new facilities are expected to meet the peak demands of the Gas and Fuel Corporation during the latter part of the current decade.

The Tuna field, which contains both natural gas and crude oil, is currently being developed and became operational in October 1978. The submarine pipeline to convey the gas from the Tuna platform to the Marlin platform was laid early in 1976 and is currently being connected. The Tuna platform template was erected on site in January 1977, construction was completed during the year, and development drilling of the production wells began on 20 October 1978. Plans are well advanced for the development of the Snapper gas field which lies between the Barracouta and Marlin fields.

Distribution and conversion

After being treated at the gas processing facilities at Longford to remove propane and butane and the pentanes, natural gas is conveyed to Melbourne City Gate at Dandenong through a main transmission pipeline which was laid in 1968 and 1969. Natural gas first became available to users in Victoria on 14 April 1969.

The distribution and appliance conversion programmes carried out by the Gas and Fuel Corporation and the privately owned companies now absorbed into the Corporation, is described in previous editions of the *Year Book*. Early in 1974, the Gas and Fuel Corporation through enabling legislation (*Gas and Fuel Corporation (Powers) Act 1974*), acquired the Albury Gas Company Limited on the Murray River bordering New South Wales, at a cost of approximately \$800,000. This legislation facilitated arrangements for laying a pipeline from Melbourne to supply natural gas to north-central Victoria, in particular to the Albury-Wodonga growth centre.

Laying of the 355 kilometres long system of pipelines was completed in January 1977 to supply towns along the Hume Highway, at the Albury-Wodonga growth centre, and at Shepparton. An appliance conversion programme is currently being carried out and these localities are now supplied with natural gas.

In Melbourne a new pipeline has been laid from South Melbourne to the Brooklyn Compressor Station to reinforce supply in the western suburbs of Melbourne and to Geelong, Ballarat, and Bendigo. At 30 June 1977, a total of 1,385,000 appliances owned by 570,107 customers had been converted to natural gas in Victoria.

Gas supply areas

At 30 June 1977, there was a total of 692,105 customers receiving natural gas in Victoria. A further 17,712 customers were using other reticulated gases, mainly reformed LPG, making a total of 709,817 customers. The areas supplied with reticulated gas at 30 June 1977 are shown in the following table:

VICTORIA—AREAS SUPPLIED WITH GAS AT 30 JUNE 1978 (a)

Supplier	Area supplied	
	Natural gas	Other gases (b)
Gas and Fuel Corporation of Victoria	Bacchus Marsh	Ararat
	Ballan	Colac
	Ballarat	Hamilton
	Benalla	Horsham
	Bendigo	Kyneton
	Castlemaine	Portland
	Euroa	Queenscliff
	Geelong	Seymour
	Lara	Stawell
	Maffra	Sunbury
	Melbourne	Warrnambool
	Morwell	
	Rosedale	
	Sale	
	Shepparton	
	Trafalgar	
	Traralgon	
	Wangaratta	
	Warragul	
	Wodonga	
Private suppliers—	Western Port	
Esso Exploration and Production Australia Inc. and Hematite Petroleum Pty Ltd (BHP)	North Geelong	

(a) Excludes Esso/BHP own plant use at Longford and Long Island Point.

(b) In addition the Gas and Fuel Corporation supplies Maryborough and Warracknabeal with bottled LPG.

Source: Department of Minerals and Energy, Victoria, 1978.

Production and sales
VICTORIA—PRODUCTION OF TREATED
NATURAL GAS (a)

Year	Quantity	
	million m ³	million ft ³
1973	1,793.526	63,338.363
1974	2,241.743	79,167.139
1975	2,565.355	90,557.032
1976	3,038.522	107,259.827
1977	3,256.752	114,963.346

(a) Includes sales, field, and plant usage.

Source: Department of National Development, Canberra.

Sales rose sharply following the introduction of natural gas in April 1969. During the twelve month period ending 30 June 1968, the last full year before the introduction of natural gas, sales showed an increase of only 5.5 per cent over the previous year. Sales during the twelve month period ending 30 June 1978 increased by 6.9 per cent.

VICTORIA — SALES OF GAS (a)
(gigajoules)

Year	Gas and Fuel Corporation of Victoria
1974-75	72,253,000
1975-76	83,628,000
1976-77	95,471,000
1977-78	102,063,000

(a) Includes Mt Gambier Gas Co. Ltd. in South Australia.

NOTE. 1 gigajoule = 9.479 therms. For sales of gas in Victoria for the years 1970-71 to 1973-74, see table on page 335 of *Victorian Year Book 1976*.

Source: Gas and Fuel Corporation of Victoria.

MINERALS

Economic natural resources*Introduction*

Victoria lacks the diversity of mineralisation present in other Australian States. However, mineral discoveries in Victoria in the past have had an important effect both on the State and Australia as a whole. The first major mineral development occurred in the 1850s with the gold discoveries and the subsequent gold rushes. A less spectacular development, but one equally important for Victoria's economy, was the utilisation of the La Trobe valley brown coal deposits for power generation in the 1920s. Of equal significance were the oil and gas discoveries in Bass Strait during the 1960s from which Victoria now supplies about 68 per cent of Australia's crude oil requirements and the whole of the State's gas needs.

The recent world energy crisis has emphasised that liquid fuel deposits are not infinite and that in the future liquid hydrocarbons may have to be manufactured from coal. Victoria, with its vast reserves of brown coal, may be in an excellent position to continue to supply a substantial part of Australia's liquid fuel requirements in the future.

Construction materials

Apart from crude oil and natural gas, construction materials exceed other mineral production, including brown coal, in terms of quantity and value. In 1976-77, the production of construction materials, including clay and limestone for lime and cement, was approximately 39,000,000 tonnes, valued at \$77.5m. The larger portion of this quantity, estimated to be as much as 60 per cent, is both produced and used within the Melbourne Statistical Division.

Basalts from the Newer Volcanic Series remain the most important source of crushed and broken stone, although the proportion of the total production is gradually declining. The reason for this decline probably lies in the difficulties in meeting specifications and the recognition by the industry that granitic rocks and acid lavas are more uniform in quality both laterally and vertically and that the quantity of stone obtainable from a particular site is limited largely by geometrical considerations.

Fossil fuel reserves

Victoria's proven geological reserves of brown coal (lignite) amount to 66,700 million tonnes, of which 64,900 million tonnes occur in the extensive coal fields of the La Trobe valley. The total inferred geological reserves down to depths at present uneconomic to mine amount to 113,700 million tonnes, but the State Electricity Commission estimates that the present economically extractable quantity is 35,000 million tonnes. This would contain an energy content of 350,000,000 terajoules.

The Bass Strait oil and natural gas fields will supply Victoria and other markets with natural gas for more than thirty years at the anticipated rate of consumption. It is estimated that an energy equivalent of 7,800,000 terajoules will be available if new gas fields are not discovered. The crude oil reserves, equivalent to 9,000,000 terajoules, will be seriously depleted by the late 1980s unless new discoveries are made in Victoria and Australia in the next ten years.

VICTORIA—ENERGY EQUIVALENT OF RECOVERABLE FOSSIL FUEL
(million terajoules)

Crude oil	Natural gas	Gas liquids	Brown coal	Total
9.0	7.8	2.1	120.0	138.9

The crude oil from the Bass Strait oil fields is deficient in the heavier lubricating fractions and the main commercial derivatives are light petroleum liquids ranging from heating oil to motor spirit. Victoria and Australia still depend on overseas crude oil for production of medium to heavy lubricating oils.

The black coal deposits of the south Gippsland coal fields such as Wonthaggi, Kilcunda, Korumburra, and Outtrim were mined during the first half of the twentieth century. The coals were of average grade, but because of thin seams and complex block faulting, mining was expensive and the final production ceased from Wonthaggi in 1968. Reserves are estimated to total 8,000,000 tonnes.

Metallic minerals

Only minor amounts of metallic minerals are produced in Victoria. The most valuable of these is gold. These minerals contribute only about 0.5 per cent of the value of mineral products.

History of mining in Victoria

Victoria owes its rapid settlement and economic growth to the rich alluvial gold discoveries of the early 1850s. Although the early settlers were pastoralists, the rapid development of mining promoted the growth of industries and financial institutions. Gold mining reached a peak in 1856 with a total production of 86,000 kilograms of gold. From 1851 to 1857, the population of Victoria increased from 97,489 persons to 456,522 persons and had reached 1,000,000 persons by 1887.

One major consequence of the gold rushes was that Melbourne became an important centre of finance and maintains this role in Australia to the present day. Exploitation of the goldfields resulted in improved transportation facilities and improved access to large areas of fertile land which in itself supported the expansion of farming and pastoral industries.

Although for a long time gold production dominated the mining industry, other minerals were mined such as tin, antimony, copper, molybdenum, and wolfram. Production of some of these metals was as a by-product of gold mining. The mining activities of Victoria in the twentieth century have been characterised by marked progress in open cut mining, particularly of brown coal, limestone, and construction materials.

Discoveries of black coal in the south Gippsland area during the late nineteenth century and the early twentieth century resulted in underground mines at Coalville, Korumburra, Jumbunna, Outtrim, Kilcunda, and Wonthaggi. The black coal deposits at Wonthaggi were discovered in 1909 and the State Coal Mine operated in this area until 1968.

Brown coal mining in the Lal Lal, Bacchus Marsh, Altona, Wensleydale, Dean's Marsh, Benwerrin, Anglesea, Gelliondale, and La Trobe valley areas has continued for many years and the operations in the La Trobe valley rank among the world's largest open cut mining projects. Coal has been extracted from Yallourn North since 1889, but the major developments have taken place since 1920 when the State Electricity Commission took over the work begun by the Mines Department in 1916. Since 1924, when large-scale production began, more than 500,000,000 tonnes of brown coal have been mined from the Yallourn and Morwell open cuts.

Since the Second World War, the rapid industrial development and recurrent building growth periods have made the production of construction materials the most extensive and valuable (apart from crude oil and natural gas) mining operation in Victoria. Limestones have been mined in large open cuts at Batesford and Waurn Ponds near Geelong, and at Merrimans Creek near Rosedale in Gippsland, for the manufacture of cement. Hard rock quarries supply aggregate and crushed rock for road construction and ferro-concrete buildings. Construction sands for concrete, plaster, and moulding are an important commodity and clays are mined by open cut methods for brick, tile, and pipe manufacture.

Victoria's economy was given another major impetus by the discovery in 1965 of the first of the large oil and gas deposits in the offshore fields of Bass Strait. Oil from Bass Strait now supplies approximately 68 per cent of total Australian requirements. It is estimated that sufficient reserves of natural gas exist to supply Victoria's need as well as other markets for more than thirty years.

Geological Survey of Victoria

The Geological Survey of Victoria was formally established in 1852 following the first reported discovery of alluvial gold in the previous year. The establishment followed an appeal by Governor La Trobe to the Colonial Office in London for urgent expert geological assistance. A.R.C. Selwyn arrived in Melbourne in 1852 to become the founding Director of the Geological Survey. Selwyn immediately initiated a programme of geological mapping and mineral resource surveys to assess the distribution and nature of the gold bearing formations. In 1867, the Geological Survey was brought under the control of the Minister of Mines and at the present time functions as a division of the Department of Minerals and Energy.

The early work of the Survey included detailed surface and subsurface mapping of the important goldfield areas, and in the 1890s studies were extended to the black coal deposits in south Gippsland. This work culminated in the discovery of the Wonthaggi coal field in the early 1900s.

In the period from 1910 to 1920, the Survey intensified the mapping programmes and undertook surveys of the brown coal deposits of the La Trobe valley. The Department initiated the re-opening of the Morwell open cut at Yallourn North and developed the brown coal fields as a source of fuel before this responsibility was transferred to the State Electricity Commission in 1920.

After the Second World War, the activities of the Survey were diversified with the growing interest in petroleum exploration, groundwater investigation, engineering geology, and the extractive industries. The studies carried out by the Geological Survey on the Tertiary stratigraphy and micropalaeontology of the onshore Gippsland Basin set a basis for the discovery of the oil and gas fields of Bass Strait during the middle 1960s.

In summary, the main activities of the Geological Survey are the investigation of Victoria's geological structure, mineral, petroleum, and groundwater resources; engineering geology; and the provision of basic information on these matters in the form of geological maps, reports, and advice to industry, the public, and Commonwealth and Victorian Government departments. The Survey also serves as geological consultant to government agencies when required, and provides scientific information for the appraisal, development, and conservation of Victoria's subsurface resources.

Mining and quarry production

The mining and quarrying production of Victoria from lands occupied under the Mines Act and the Extractive Industries Act is recorded by the Victorian Department of Minerals and Energy, and from other lands by the Australian Bureau of Statistics. The production from both sources for the years 1973-74 to 1976-77 is shown in the following table:

VICTORIA—MINING AND QUARRYING PRODUCTION

Particulars	1973-74		1974-75		1975-76		1976-77	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	'000 gm	\$'000	'000 gm	\$'000	'000 gm	\$'000	'000 gm	\$'000
Metallic minerals (a)—								
Gold bullion	75	(b)81	249	225	119	343	42	112
	tonne		tonne		tonne		tonne	
Antimony ore	2,318	57	2,703	34	507	11	1,227	21
Bauxite	6,669	57	—	—	2,366	38	5,579	47
Iron ore	466	3	487	4	6,650	73	1,785	17
Tin concentrate	9	26	5	22	—	—	2	10
Non-metallic minerals—								
Diatomite	6,000	35	4,979	22	498	34	437	48
Fireclay	38,484	80	14,280	40	14,777	64	17,944	107
Fluorspar	874	49	—	—	—	—	—	—
Gypsum	49,825	149	54,139	161	69,006	240	84,761	310
Kaolin, refined	27,856	1,493	26,135	1,441	16,663	1,308	18,616	1,572
Kaolin, unrefined (c)	1,623	21	8,077	40	414	7	276	4
Limestone (d)	2,424,380	n.a.	2,139,529	n.a.	2,170,684	n.a.	2,081,201	n.a.
Other clays	2,736,979	2,524	2,222,221	2,343	2,478,992	3,114	2,097,622	2,578
Silica	141,832	460	142,550	445	166,273	708	199,416	960
Fuel minerals—								
Briquettes	1,163,922	11,011	1,092,134	11,391	945,793	11,974	1,034,786	14,925
Brown coal (e)	23,253,577	27,823	24,641,462	40,556	26,711,090	48,346	28,231,206	55,905
	'000m ³		'000m ³		'000m ³		'000m ³	
Crude oil	20,712		20,930		21,795		22,647	
Liquefied petroleum gases (f)—								
Commercial butane	929		1,147		1,181		1,324	
Commercial propane	1,123		1,025		1,051		1,207	
	million m ³	330,060 (h)	million m ³	395,311 (h)	million m ³	430,634 (h)	million m ³	458,818 (h)
Natural gas (g)	1,998		2,284		2,641		2,989	
Other derivatives (f)—	'000 m ³		'000 m ³		'000 m ³		'000 m ³	
Commercial ethane	40,620		63,677		73,208		103,350	
Construction materials—								
Sand	7,788	11,086	7,541	11,726	r7,765	r12,832	9,040	14,626
Gravel	4,858	4,307	4,732	3,986	r4,095	r3,304	4,743	4,367
Crushed and broken stone	17,499	35,373	17,682	43,298	r17,430	r48,742	17,884	48,388
	tonne		tonne		tonne		tonne	
Dimension stone	10,937	217	12,283	262	10,621	256	7,867	288
	'000 tonnes		'000 tonnes		'000 tonnes		'000 tonnes	
Other quarry products	4,201	3,686	3,636	4,127	r2,738	r2,905	3,327	3,886

- (a) See next table for assayed content.
 (b) Includes gold subsidy of \$36,361 in 1972-73, and \$18 in 1973-74. Gold subsidy payments ceased at 31 December 1973.
 (c) Excludes unrefined kaolin used in producing refined kaolin at or near mine.
 (d) Excludes limestone used as a construction material.
 (e) Excludes brown coal used in production of briquettes: 1973-74: 3,097,000 tonnes; 1974-75: 2,955,000 tonnes; 1975-76: 2,512,000 tonnes; 1976-77: 2,763,000 tonnes.
 (f) Excludes manufactured liquefied petroleum gases and other derivatives from petroleum refining.
 (g) Includes commercial gas and gas for field usage.
 (h) Value shown is an estimate based on prices prescribed in legislation, quoted market prices, and information from government departments. Values of individual petroleum products are not available for publication.
- Sources: Department of Minerals and Energy, Victoria; Fuel Branch, Commonwealth Department of National Development; and Australian Bureau of Statistics.

VICTORIA—ASSAYED CONTENT OF METALLIC MINERALS

Metal or element and mineral in which contained	1972-73	1973-74	1974-75	1975-76	1976-77
Alumina (tonne)—					
Contained in bauxite	1,977	2,819	—	1,214	2,829
Antimony (tonne)—					
Contained in antimony concentrate	—	—	—	—	—
Contained in antimony ore	n.a.	110	278	60	109
Total antimony	n.a.	110	278	60	109
Gold (gm)—					
Contained in antimony ore	—	158	—	—	—
Contained in antimony concentrate	—	—	—	—	—
Contained in copper concentrate	—	—	—	—	—
Contained in gold bullion	141,054	67,783	217,794	105,582	40,175
Total gold	141,054	67,941	217,794	105,582	40,175
Iron (tonne)—					
Contained in bauxite	310	209	—	121	324
Contained in iron ore	322	280	292	3,990	1,071
Total iron	632	489	292	4,111	1,395
Rutile (tonne)—					
Contained in bauxite	—	—	—	118	—
Silica (tonne)—					
Contained in bauxite	—	—	—	289	—
Silver (gm)—					
Contained in gold bullion	3,732	n.a.	n.a.	n.a.	n.a.
Tin (tonne)—					
Contained in tin concentrate	7	7	4	—	1

Sources: Department of Minerals and Energy, Victoria, and Australian Bureau of Statistics.

VICTORIA—COAL PRODUCTION AND VALUE (a)

Period (b)	Black coal		Brown coal	
	Production	Value	Production	Value
	tonnes	\$'000	tonnes	\$'000
1926-1930	678,901	1,786	1,539,917	386
1931-1935	479,606	888	2,484,461	512
1936-1940	330,118	568	3,666,671	712
1941-1945	290,872	818	5,090,974	1,052
1946-1950	158,798	722	6,755,137	2,404
1951-1955	145,838	1,590	8,868,202	7,186
1956-1960	102,512	1,050	12,389,332	11,302
1961-1965	53,418	599	18,607,269	16,605
1966	36,089	497	22,132,593	20,064
1967	32,581	251	23,758,913	20,686
1968	26,736	209	23,339,331	21,555
1968-69	13,312	105	23,499,703	20,879
1969-70	407	6	24,310,900	22,131
1970-71	20	(c)	23,180,539	22,975
1971-72	—	—	23,630,467	25,706
1972-73	—	—	24,121,155	28,555
1973-74	—	—	26,354,577	31,532
1974-75	—	—	27,541,462	45,341
1975-76	—	—	29,211,090	52,871
1976-77	—	—	30,994,476	61,598

- (a) Value of output at the mine. This is essentially the unit selling price of the commodity, less any unit transport costs from the mine or associated treatment works, multiplied by the production. Where a commodity is transferred to another location for further processing without being sold, the unit value is based on production costs plus an allowance for overhead and profit.
 (b) Figures for five-yearly periods are annual averages.
 (c) Under \$1,000.

Further references: Groundwater in Victoria, *Victorian Year Book* 1969, pp. 384-6; Victorian clays 1970, pp. 376-8; History of the Mines Department, 1970, pp. 105-8; Minerals in Victoria, 1970, pp. 1-29; Mineral exploration, 1972, pp. 363-7; Geological Survey of Victoria, 1975, pp. 362-3; Extractive industries, 1975, pp. 364-5; Mineral deposits in Victoria, 1976, pp. 362-3; Mines Department, 1977, pp. 367-9

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